

# **MIDLAND** LMR

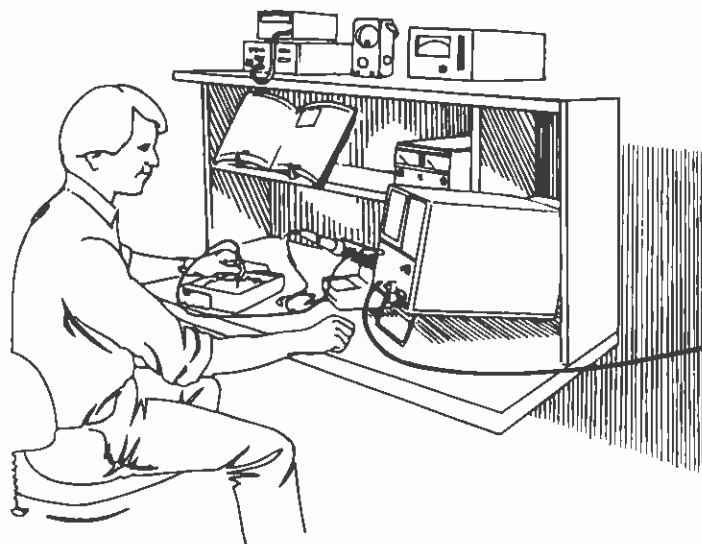
**LAND MOBILE RADIO**

## **SERVICE MANUAL**



**70 -1340A/B AND 70 -1440A/B  
SYN-TECH XTR**

**FM TWO-WAY  
LAND MOBILE RADIO  
VHF HIGH BAND  
(136 -160MHz/148 -174MHz)  
2 - 40 WATT**



MANUAL NO. 70-134144  
09-1340/1440-SM-12/94-2M

PRINTED IN U.S.A.

This user's manual is designed to facilitate the set-up and service of the Midland 70-1340/1440 SYN-TECH XTR mobile transceivers. As necessary, user's manual supplements will be published and distributed on the following forms:

- Manual Addition (MA) . . . . . For supplemental information useful in product service or improvement. Printed on BLUE paper.
- Change Notice (CN) . . . . . For details about changes made during production by model and serial number. Printed on YELLOW paper.
- Manual Correction (MC) . . . . . For correcting literature errors not related to production changes. Printed on GREEN paper.
- Technical Bulletin (TB) . . . . . For solutions to field problems and tips for performance improvement. Printed on PINK paper.

Comments or suggestions concerning areas of manual improvement are welcome.

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## ACRONYMS AND ABBREVIATIONS

Below is a list of common electrical acronyms and abbreviations used in this manual.

ANI .....	Automatic Number Identification
CTCSS .....	Continuous Tone-Controlled Squelch System
DCS (or CDCSS) .....	Continuous Digital-Controlled Squelch System
DTMF .....	Dual Tone Multi-Frequency
E <sup>2</sup> PROM .....	Electrically Erasable Programmable Read Only Memory
MIL .....	Military Specification
RX .....	Receive
SINAD .....	The ratio in decibels of signal + noise + distortion to noise + distortion
TX .....	Transmit
VCO .....	Voltage Controlled Oscillator

**SECTION 1****GENERAL INFORMATION**

**GENERAL INFORMATION**

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70-1340/1440

**NOTES**



**DESCRIPTION****1**

The 70-1340/1440 MIDLAND SYN-TECH XTR transceivers are programmable frequency-synthesized two-way FM mobile radios that operate in the high-band VHF frequency range. They are programmable for up to 22 channels, or up 99 channel with plug-in option.

The 70-1340/1440 are designed to operate within either of two frequency ranges: 136-160 MHz (A-Band), or 148-174 MHz (B-Band). Transmit RF power is programmable for 2—40 watts.

There are two types of control head configurations for the SYN-TECH XTR. Either the entire radio can

be mounted under the vehicle dashboard (model number 70-1340), or the bulk of the radio can be placed under a seat or in the trunk, with only the control panel mounted in the operator's reach (model number 70-1440). If the 70-1340 is purchased, the XTR is shipped with the Control Panel attached. If the 70-1440 is purchased, the XTR is shipped with a cable-interface board and handle assembly mounted in place of the Control Head, and a cable-interface board and a rear cover are added to the Control Head. The two units must be connected together with a multiconductor cable when installed.

**SPECIFICATIONS**

Refer to EIA-152-C, EIA/TIA-204-D, and DOC RSS-119, Issue 3 for standard of performance and method of measurement.

**GENERAL****OPERATING FREQUENCY RANGE:**

A-Band: 136 - 160 MHz

B-Band: 148 - 174 MHz

**COMMUNICATION SYSTEMS:** Press-to-talk (1 or 2 frequency simplex)

**CHANNEL SPACING:** 30 kHz

**CHANNEL STEPPING:** 2.5 kHz

**CHANNELS:** 22 or 99 (optional)

**REFERENCE OSCILLATOR:** Computer-compensated crystal (TCXO optional)

**DUTY CYCLE:** 1 minute TX, 4 minute RX

**POWER SUPPLY:** 13.6 V DC negative to ground

**OPERATING VOLTAGE RANGE:** 12.2 to 15.0 V

**ABSOLUTE VOLTAGE RANGE:** 10.5 to 16.0 V

## GENERAL INFORMATION

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70-1340/1440

**CURRENT DRAIN:**

Standby: 0.4 A (approx.)  
Receive at 10 W: 2.0 A (approx.)  
Transmit: 8.0 A (approx.)

**RF IMPEDANCE:** 50  $\Omega$  unbalanced:

**OPERATION TEMPERATURE:** -30° C to +60° C

**RELATIVE HUMIDITY:** 90% at 50° C  $\pm$ 2° C

**VIBRATION/SHOCK:** MIL 810 C/D (With T/M mounting bracket)

**DIMENSIONS (H x W x D):**

Dash-mount: 2.25 x 7.75 x 8.86 in (57 x 196 x 225 mm)  
Trunk-mount: 2.25 x 7.75 x 9.65 in (57 x 120 x 84 mm)  
Remote Control Head: 2.25 x 4.75 x 3.31 in (57 x 120 x 84 mm)  
Speaker: 4.81 x 4.81 x 2.87 in (121 x 121 x 72 mm)

**WEIGHT:**

Dash-mount: 5.7 lb (2.6 kg)  
Trunk-mount: 6.1 lb (2.8 kg)  
Remote Control Head: 0.8 lb (0.36 kg)  
Speaker: 1.38 lb (0.63 kg)

## TRANSMITTER

**RF POWER OUTPUT (programmable):** 2—40 W, dual RF power levels

**FREQUENCY STABILITY (-30° C to +60° C):**  $\pm$ 0.0005% standard,  $\pm$ 0.0002%, optional

**MODULATION (direct FM):** 16K0F3E, 5 kHz maximum

**FREQUENCY SEPARATION:**

At 40 W: 10 MHz  
At 30 W: 24 MHz A-Band; 26 MHz B-Band

**SPURIOUS & HARMONICS:** -80 dB

**FM HUM & NOISE:** -50 dB

**AUDIO RESPONSE:** per EIA and DOC specifications

**AUDIO DISTORTION (at 60% deviation):** 3% or less at 1000 Hz

**OUTPUT IMPEDANCE:** 50  $\Omega$

**RECEIVER**

**FREQUENCY STABILITY** (–30° C to +60° C):  $\pm 0.0005\%$  standard,  $\pm 0.0002\%$  optional

**SENSITIVITY** (12 dB SINAD): 0.30  $\mu$ V

**SELECTIVITY** ( $\pm 30$  kHz): –80 dB

**FREQUENCY SEPARATION**: 24 MHz A-Band; 26 MHz B-Band

**ACCEPTABLE RADIO FREQ. DISPLACEMENT**:  $\pm 3.5$  kHz minimum

**SPURIOUS REJECTION**: –80 dB

**INTERMODULATION**: –78 dB

**SQUELCH SENSITIVITY**: 0.18  $\mu$ V maximum

**AUDIO OUTPUT:**

Int: 3 W at 3% distortion or less

Ext: 10 W at 3% distortion or less (into 3.2  $\Omega$ )  
(Trunk-mount models measured at control head accessory connector with 4 meter maximum control cable. For longer control cables, measurement must be made at accessory connector on rear of radio.)

**INPUT IMPEDANCE**: 50  $\Omega$

— All specifications subject to change without notice —

**ACCESSORIES****OPTION KITS:**

70-2180.....	99 Channel Option
70-2143.....	Scan Kit
70-2119.....	2 ppm Frequency Stability Kit
70-2120.....	2.5 ppm Frequency Stability Kit
70-2129.....	2nd IF Reverse Injection Kit
70-2963.....	MIL 810 C/D dust/rain/salt fog Kit (T/M Control Head and Main Unit)
70-2963-1.....	MIL 810 C/D dust/rain/salt fog Kit (T/M Control Head only)
70-2963-2.....	MIL 810 C/D dust/rain/salt fog Kit (T/M Main Unit only)

## GENERAL INFORMATION

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70-1340/1440

### SIGNALLING OPTIONS

70-2157.....	CTCSS/DCS Filter
70-2410.....	Digital Voice Storage/In Band Repeater (Requires 2413A Interface Board)
70-2412A .....	Rolling Code Variable Split Band Scrambler (Requires 2413A Interface Board)
70-2413A .....	Interface Board
70-2415.....	2 Tone Sequential Decoder
70-2416.....	Private Squelch
70-2418.....	Burst Tone Encoder
70-2419.....	Reverse Burst Generator
70-2420B .....	DTMF Decoder

### SPEAKERS AND MICROPHONES

70-2302.....	Weatherproof Microphone
70-2306.....	Microphone
70-2103A .....	DTMF Microphone with Up-Down Channel Switch w/6 Pin Jack Kit (70-K33-1)
70-2104A .....	DTMF Microphone with Up-Down Channel Switch and ANI w/ 6 Pin Jack Kit (70-K33-1)
70-2305B .....	Dynamic Base Station Microphone (w/70-K33-1)
70-2311.....	Telephone Handset (requires 70-K37)
70-2195.....	CTCSS Microphone Hang-Up switch
70-2355.....	15 Watt Remote Speaker
70-2356.....	15 Watt Weatherproof Speaker
70-2365.....	15 Watt Horn Speaker
70-2325.....	Heavy Duty Amplified Condensor DTMF Microphone (w/ illuminated keypad)

### MISCELLANEOUS

70-2249.....	Conversion Kit — Trunk Mount to Dash Mount
70-2250.....	Conversion Kit — Dash Mount to Trunk Mount
70-2283.....	DC Power Supply for Dash or Trunk Mount Mobile 110 V/220V AC, 15 A
70-7070.....	Weatherproof Housing
70-2218.....	Ignition Relay Kit
70-2925.....	Memory Back up Kit (Short Term)*
70-2926.....	Memory Back up Kit (Long Term)*
70-2196.....	Electronic Noise Filter, 10 A
70-2197.....	Electronic Noise Filter, 25 A

\* On B-Band models, not applicable to units below Serial Number 002501.

**SECTION 2**

**PREPARATION**

## PREPARATION

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70-1340/1440

## NOTES

**NOTE:** Use the 70-1080A Programmer or 70-1489 PC Programming software to program the 70-1340/1440.

## PREINSTALLATION CHECK

### • Setup

1. Remove the four securing screws on the cover, and the cover itself.
2. If not already in place, connect the proper Control Head to the TX/RX Unit.
3. Connect a resistive, 50  $\Omega$  RF load (with a wattmeter) to Antenna Jack J501.
4. Connect 13.6 V DC power to J415.
5. Turn the radio on, turn MON on, and turn selective signaling options off.

### • Carrier Frequency

6. Initiate transmit on any channel. Measure transmitted RF carrier frequency without modulation. Next, set carrier frequency to within  $\pm 400$  Hz of channel frequency by adjusting L101. Refer to crystal alignment on page 2 - 8.

7. Adjust RF output power using the programmer. To do so, please see the section entitled "PA MODULE ALIGNMENT" on page 2 - 5.

### • Maximum Deviation

8. Select a channel with transmit frequency 136 MHz for A-Band, or 150 MHz for B-Band. If CTCSS or DCS is used, be sure this channel is programmed to send the same frequency.
9. Disconnect the hand microphone from its front panel receptacle J301.
10. Apply 3 V<sub>rms</sub> of 1000 Hz signal to pin 1 of MIC Jack J301, then initiate transmit by grounding pin 4. Measure total carrier deviation. If it is not below  $\pm 5$  kHz (including optional CTCSS/DCS signal), see MODULATOR ALIGNMENT on page 5.

## START-UP

**NOTE:** A programmer must be used (either the 70-1080A Programmer Version 10.4 or later, or 70-1489 PC Programming Software) to program VHF High Band SYNTech XTR radios.

1. Program the radio customer frequencies and select features using the programmer and its instruction manual.
3. Install the radio into the vehicle. See Section 3.

2. The 70-1340/1440 Units are capable of operating across a wide band of channel frequencies; frequency selective circuits do not require realignment after the units are programmed with customer channel frequencies. After programming, only a general check of proper operation is needed. If any minor adjustments are necessary, refer to COMPLETE REALIGNMENT. These adjustments are of a general nature and do not require atypical equipment.

**CAUTION:** Do not ground any speaker wires because they are all electrically hot (each wire is connected to a differential audio amplifier output).

**NOTE:** You must use the 70-1080A Programmer or the 70-1083 Jumper Plug, or 70-1489 PC Programming software to set Carrier Frequency, Maximum Deviation, and RF Output Power.

## PREPARATION

70-1340/1440

### COMPLETE REALIGNMENT

Complete realignment is only needed when a component that affects alignment has been replaced. RADIO REPROGRAMMING WITH TEST FREQUENCIES IS REQUIRED.

#### TEST EQUIPMENT REQUIRED

TEST INSTRUMENT	INSTRUMENT CAPABILITIES	USE
Regulated DC Power	13.8 V DC, 15 A	Radio power source
RF Wattmeter for 70-1340/1440	75 W, 136—174 MHz, 50 $\Omega$ circuit	Transmitter power measurements
RF Load Resistor	50 $\Omega$ , 200 W	Antenna dummy load
Frequency Modulation Meter	136—174 MHz, peak- responding, $\pm 5$ kHz range	Modulation level measurements
Frequency Meter or Frequency Counter	136—174 MHz, 1.0 ppm accuracy	Carrier frequency measurement
RF Signal Generator	136—174 MHz range, 0.1-1 K $\mu$ V output, 3 kHz FM mod. with 1 kHz tone	All receiver measurements
Distortion Analyzer	1 kHz notch, 1% measuring range	Receiver performance test and IF alignment
Load Resistor (audio)	3.2 $\Omega$ , 20 W	Speaker load for all receiver measurements
AC Voltmeter	10 mV to 3 V <sub>rms</sub>	Audio level adjustments
Oscilloscope	DC to 500 kHz bandwidth	
Digital Multimeter	0.1 to 20 V DC	Test point measurements and power supply setup
Programmer	MIDLAND 70-1080A, or 70-1489 PC Programming Software	Manual radio control



## SETUP

1. Remove the four securing screws on the cover, and the cover itself.
2. If not already in place, connect the proper Control Head to the TX/RX Unit.
3. Connect a resistive 50  $\Omega$  RF load and a wattmeter to Antenna Connector J501.
4. Connect 13.6 DC power to transceiver J415.
5. Connect a 3.2  $\Omega$ , 20 W resistor to pins 4 and 6 of the Accessory Plug. The jumper between pins 5 and 6 must be temporarily disconnected to make this connection. The resistor serves as a constant load to replace the speaker's inconsistencies.
3. Activate the transmit mode (using the Programmer). Adjust Channel TX Tank L733 to obtain 1.5 V DC on CM701 pin 2.

### • Reference Oscillator

4. Initiate transmit on any channel. Measure transmitted RF carrier frequency without modulation. Set carrier frequency to within  $\pm 400$  Hz of channel frequency by adjusting L101.

## PA MODULE ALIGNMENT

The SYN-TECH XTR can be adjusted to either have a 24 MHz channel spread at 30 W, or a 10 MHz channel spread at 40 W.

### • 24 MHz Channel Spread

1. Change the TX test frequency to 148.00 MHz for A-Band, 162.00 MHz for B-Band.
2. Activate transmit mode, then adjust CV501 to obtain maximum RF power at Antenna Connector J501.
3. Set RF output power to 30 W at J501 using the programmer.

### • 10 MHz Channel Spread

1. Change the TX test frequency to a frequency at the center of desired 10 MHz spread.
2. Activate transmit mode, then adjust CV501 to obtain maximum power at Antenna Connector J501.
3. Set the RF output power to 40 W at J501 using the programmer.

### • Low Power Adjustment (If Used)

1. Select Low Transmit Output Power.
2. Set RF output power to desired 10 W power setting at J501 using the programmer.

**CAUTION:** Both speaker terminals are LIVE. Never ground either one. Connect grounded receive-audio measuring-equipment to only one side of the speaker and chassis ground. Normally, voltage measurements will be half of their true values.

6. Turn the radio on, set the VOLUME control to a midposition, and set the SQUELCH control fully counter-clockwise.
7. Connect the programmer to Programming Port J402. Upload the radio programming DataPacket into the Programmer and initiate its Remote Control Mode. Refer to the appropriate operator's manual for instructions.

## SYNTHESIZER ALIGNMENT

### • VCO Resonance

1. Select the Remote Control Mode of the Programmer and enter the following test frequencies:

	A-Band	B-Band
RX Frequency	136.00	150.00
TX Frequency	136.00	150.00
2. Adjust Channel RX Tank L713 to obtain 1.5 V DC on CM701 pin 2 (VCO Steering).

## PREPARATION

70-1340/1440

### MODULATOR ALIGNMENT

Always perform Modulator Alignment in its entirety; the following adjustments are interactive.

- **Modulation Limiting**

1. Disconnect the hand microphone from its front panel receptacle J301.
2. Apply 3 V<sub>rms</sub> of 1000 Hz signal to pin 1 of Mic Jack J301, then initiate transmit (if not using a programmer, ground J301 pin 4).
3. Measure total carrier deviation, then use the programmer to adjust modulation limiting to  $\pm 5$  kHz.

- **Microphone Gain**

4. No alignment for microphone gain is required.

- **DCS Modulation (If Installed)**

5. Enter DCS code +023, and adjust RV1 CTCSS/DCS so that DCS deviation is at 750 Hz  $\pm 100$  Hz.
6. While observing recovered modulation on an oscilloscope, fine tune RV401 for a square DCS waveform as shown:



CORRECT

INCORRECT

INCORRECT

8. Readjust DCS deviation to 750 Hz  $\pm 100$  Hz.
9. Set frequency to CTCSS at 250.3 Hz. Adjust RV401 for 750 Hz  $\pm 100$  Hz deviation.

10. Set to DCS frequency. Fine tune RV401 for a square DCS waveform as shown.

11. Check CTCSS so that deviation is in 0.6—0.9 kHz range.

### RECEIVER ALIGNMENT

1. Change the RX test frequency to 148.20 MHz for A-Band, 162.30 MHz for B-Band.

- **First Injection**

2. No adjustment for the first injection is required.

- **Preselector Alignment**

3. No adjustment for the preselector (L201, L202, L203, L204, L205 and L206) is required.

- **Quadrature Detector**

4. Apply 1 mV of modulated (by 1 kHz tone at  $\pm 3$  kHz deviation) on-channel RF signal to Antenna Jack J501. Adjust Detector L250 for maximum audio output.

- **First I.F.**

5. Apply enough modulated (by 1 kHz tone at  $\pm 3$  kHz deviation) on-channel carrier to maintain 12 to 15 dB SINAD. Adjust L245, L246, L247 and L248.

- **Tight Squelch**

6. Set the front panel SQUELCH control to maximum (full clockwise). Set Squelch Range RV241 fully counter-clockwise.

7. Apply 1.5  $\mu$ V of unmodulated on-channel RF signal to the 50  $\Omega$  antenna connector. Adjust Squelch Range RV241 clockwise until squelch just opens (audio on).

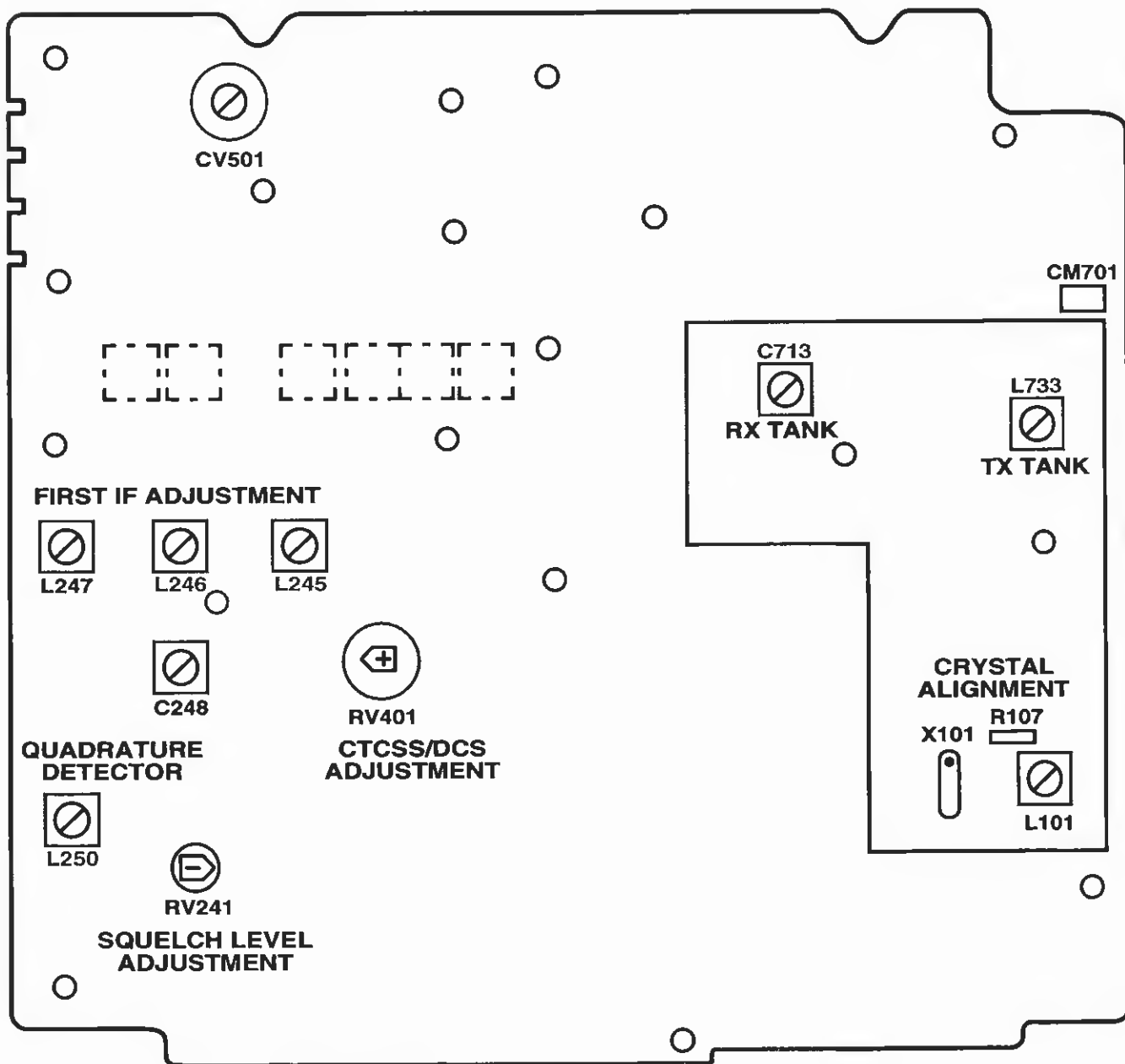


Figure 2 - 1 — Adjustment Map

## PREPARATION

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70-1340/1440

### CRYSTAL ALIGNMENT

This alignment is required when a part in the reference oscillator circuit is replaced. This alignment is not needed during normal maintenance and radio alignment or programming.

When parts in the reference oscillator circuit are replaced, including the crystal, it is necessary to select the temperature compensation data of the microcomputer in accordance to the crystal markings. There are three types of crystals as (see **Table 2 - 2**). There are two ways to determine what type of crystal you have, either by the color of the dot on the top of the crystal or the type number on the side. See the example shown in **Figure 2 - 2**. See **Figure 2 - 1** for crystal location.

The procedure varies depending on what programmer is used. Proceed to the correct instructions for the programmer you are using.

#### • 70-1080A Programmer

Refer to the 70-1080A Programmer's Manual for more information.

1. Connect the radio to power and test equipment as described under the alignment procedure section of the service manual.
2. Connect the 70-1080A programmer to the radio.
3. Upload the contents of the radio into the 70-1080A programmer.
4. Enter the test mode by pressing **CH, 0**, then **ENT**.
5. Enter the correct RX (receive) and TX (transmit) test frequency for the radio. **NOTE:** The CTCSS and DCS does not need to be used for this test.
6. Press **GRP, 4**, then **ENT**. "XTAL CHANGE OK ?" will be displayed.
7. Press **ENT**. "XTAL TYPE SELECT" will be displayed. Determine the type of crystal the radio has installed as shown in **Figures 2 - 2** and enter the correct type as shown in **Table 2 - 2**.
8. Press **ENT**. "DA CONTROL" will be displayed.
9. Press **3**, then **ENT**. "FO CONTROL" with a number (0 — 63) on the bottom line, representing the adjustment point of the reference oscillator frequency trim, will be displayed.
10. Measure the temperature of the body of R107 using a contact type thermometer. You must hold the thermometer on R107 for at least one minute before taking the temperature reading. R107 is located under the VCO shield (see **Figure 2 - 1**).
11. Using a digital voltmeter, measure the DC voltage on pin 60 of the microcomputer.
12. Find the measured temperature of R107 in **Table 2 - 3** and find the corresponding voltage for the type of crystal installed. Compare this voltage to that measured in step 11.
13. If the voltage does not match within 0.02 V DC, adjust it by using the **UP** or **DOWN** keys on the 70-1080A programmer until the DC voltage on pin 60 of the microcomputer is correct. Typical setting should be between 30 — 40.
14. When complete press **FNC**, then **OPT**. "DA DATA PROG END" will be displayed.
15. Initiate transmit and adjust L101 to within  $\pm 100$  Hz of test frequency.
16. Return the radio to normal operation.

## • 70-1489 Computer Based Programmer

Refer to the 70-1489 Computer Based Programmer's Manual for more information.

1. Connect the radio to power and test equipment as described under the alignment procedure section of the service manual.
2. Connect the radio to the computer as described in the Computer Based Programmer's manual.
3. Upload the contents of the radio into the computer.
4. Enter the test mode of the program.
5. Select **RX-TX** in the **TEST MODE** and press **ENTER**.
6. Select **TX** in the **RX-TX MODE** and press **ENTER**.
7. Enter the correct **RX** (receive) and **TX** (transmit) test frequency for the radio. **NOTE:** The **CTCSS/DCS** tones/codes do not need to be used for this test. Do not leave the **CHANNEL DATA FORM** screen at this time.
8. Measure the temperature of the body of **R107** using a contact type thermometer. You must hold the thermometer on **R107** for at least one minute before taking the temperature reading. **R107** is located under the **VCO** shield (see **Figure 2 - 1**).
9. Determine the type of crystal the radio has installed as shown in **Table 2 - 2** and **Figure 2 - 2**.
10. Using a digital voltmeter, measure the **DC** voltage on pin 60 of the microcomputer.
11. Find the measured temperature of **R107** in **Table 2 - 3** and find the corresponding voltage for the type of crystal installed. Compare this voltage to that measured in step 10. If the voltage is within 0.02 volts **DC**, then return the radio to normal operation. Otherwise:
12. Press **ESC** then **ENTER**.
13. Select **TX-CONTROL** in the **TX MODE** and press **ENTER**.
14. Use the **DOWN** arrow to select **CRYSTAL TYPE** and press **ENTER**. This will open the choice window.
15. Select the correct crystal type that the radio has and press **ENTER**.
16. Use the **UP** arrow to select the **REFERENCE FREQUENCY ADJUSTMENT**.
17. Using the **F5 — F8** keys, adjust the voltage to within 0.02 V **DC** of the voltage determined in step 11. The typical setting of the **REFERENCE FREQUENCY ADJUSTMENT** should be between 30 — 40. Press **ENTER** after each entry of the **F5 — F8**. After completion of the adjustment of the voltage on pin 60 of the microcomputer, press **ESC**.
18. Select **SAVE-TX** in the **TX MODE** and press **ENTER**.
19. Initiate transmit and adjust **L101** to within  $\pm 100$  Hz of test frequency.
20. Return the radio to normal operation.

PREPARATION

70-1340/1440

Table 2 - 2

CRYSTAL TYPE	I	II	III
CRYSTAL TYPE COLOR OF DOT ON TOP	BLACK	BLUE	RED
CRYSTAL TYPE TYPE NO. ON SIDE	1	2	3
TYPE NO. TO ENTER IN PROG MODE	1	2	3

Figure 2 - 2

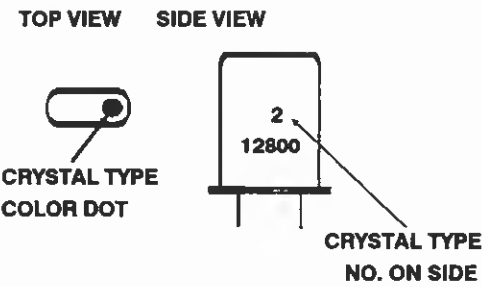
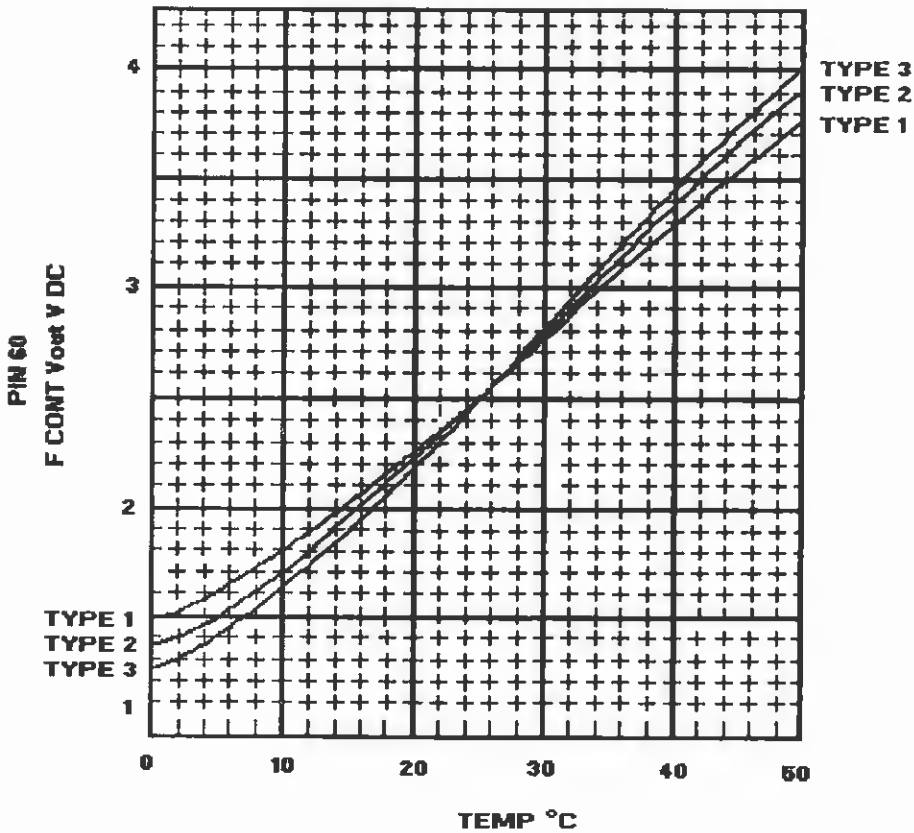


Table 2 - 3



## TRANSCEIVER ERROR CODES

When the Syn-Tech XTR radio is turned on, it performs a self-test that reports success by illuminating all displays and indicators momentarily. If a problem occurs, the radio will beep and an error code will appear in the channel display. Please note that multiple error codes will be displayed in sequence when the radio is turned on if multiple problems exist. In many cases, the error display can be cleared by pressing any button, but will re-occur at the next unit power-up.

CODE	MEANING
E1	Microcomputer error — ROM/RAM
E2	No Model/No Channel Data Programmed
E3	Synthesizer Unlock
E4	Sum error of channel data
E7*	Power disconnected — previous front panel control conditions were lost
E8	Programming I/F error
E9	Clone I/F error

\*Note that E7 is the normal power-up display when the power has been disconnected for some period of time. When E7 is displayed, it simply means that the last selected channel number and front panel switch configuration (SCAN on or off, etc.) has been lost. All basic radio data (channel frequencies, etc.) is written in non-volatile memory and cannot be changed or lost without reprogramming.

### 70-1083 PROGRAMMING JUMPER PLUG

The 70-1083 Programming Jumper Plug allows transmit parameters to be programmed from the front panel of the SYN-TECH XTR without the use of the 70-1080A Programmer.

1. Connect the radio to a power source and test equipment as described under the transmitter alignment procedure of the preliminary service information or service manual.
2. Turn the radio on. Lift the rubber programmer port cover and insert the 70-1083 plug. Make sure that the keyed side is inserted toward the right side of the radio.
3. Press and hold the **PTT** bar. Press the first switch to the right of the channel display (normally labeled **MON**). The channel display will change from the previously displayed channel to a "1". This indicates that the first parameter (maximum deviation) can be adjusted.
4. With the appropriate audio signal input to the microphone circuit, monitor the transmitter deviation on connected test equipment and rotate the channel selector to the left or right to achieve the desired level, not to exceed 5 kHz.
5. When complete, press **MON** again, and a "2" will be displayed, which indicates normal RF power may be adjusted. This power level will apply to all channels not programmed for low power.
6. Rotate the channel selector to the desired level.
7. When complete, press **MON** again, and a "3" will appear. The low power level can now be adjusted, which will apply to all channels programmed for low power.
8. When complete, press **MON** again, and a "4" will appear. The oscillator may now be trimmed to the correct frequency if necessary.
9. When complete, press **MON** again, and the original channel number will appear. Now **PTT** can be released and the 70-1083 jumper plug can be removed.

**NOTE:** **PTT** can be released at any time without loss of entered adjustments. If this is done, the channel display will revert to the originally selected channel, but the unit is still in the test mode. When the unit is keyed again, adjustments can be made again. When **MON** is pressed again, the channel number will be replaced with the number representing the next adjustment step.

**NOTE:** The unit **MUST** be cycled back to the original channel number with **MON** before the adjustments will be written to the radio EEPROM, even if adjustments are not made on some parameters. If the 70-1083 is removed before this is done, the entered adjustments are lost.



**SECTION 3**

**INSTALLATION**

# INSTALLATION

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70-1340/1440

## NOTES

## INSTALLATION

### MOUNTING

#### • Under-dash

The 70-1340A/B mounting bracket slides into the transceiver siderails and provides a 3.25" x 7.75" flat surface across the transceiver top with holes for bolting to a flat surface in the vehicle. 5/32" holes must be drilled in the mounting surface to accept the four 3/8" screws and washers provided.

#### • Trunk-Mount

The operator controls for the 70-1440A/B transceiver are inside a compact control head for operator access, while the bulk of the transceiver is located in a separate remotely mounted unit. It does not have an internal speaker. Instead, a separate 3.2  $\Omega$  external speaker (included with the 70-1440 package) must be installed and connected to the Control Head.

The cable that interconnects the Control Head to the trunk unit is four meters long and flat for laying under carpeting. The cable must not lay near hot areas (above the catalytic converter, for example), or against sharp edges.

A trunk unit mounting tray is provided with each transceiver. The flat tray is 7.5" square and must be bolted to surface where the trunk unit will mount. 5/32" holes must be drilled in the mounting surface to accept the four 3/8" screws and washers provided. The 13" x 8" x 3" trunk unit then clips onto the tray.

A Control Head mounting bracket is provided with each transceiver. Its surface is 3/4" wide and 4" long with two screw holes 2" apart. 5/32" holes must be drilled in the mounting surface of the vehicle to accept the 3/8" screws and washers provided. The Control Head and Bracket assembly is 2 1/2 inches deep. At least 3/4 inch of additional depth is needed for the connectors that attach to the rear of the Control Head.

### POWER

#### • Connections

For Under-Dash units, the Power/Accessory Cable is equipped with two unterminated 14 gauge wires two meters in length for connection to the vehicle electrical system. For Trunk-Mount units, the 70-2212B Power Cable is equipped with two unterminated 12 gauge wires six meters in length. These lengths will be sufficient for typical connection to a fuse block and chassis ground.

Connect the black wire to the negative (-) chassis ground of the vehicle. **DO NOT ATTEMPT TO INSTALL THE TRANSCEIVER IN A POSITIVE GROUND VEHICLE.** A large bolt that screws into the metallic vehicle body or chassis often provides an adequate ground if a lug is used to secure the wire to it.

Connect the red wire to the positive (+) side of the vehicle electrical system. Because of current requirements, connection to an existing fused circuit should be avoided to prevent overload of that fuse. This wire has its own in-line fuse for protection against wire penetration and transceiver defect. The connection can be made to the ignition hot so that the transceiver switches on with ignition, or it can be made to battery hot to enable the last-selected-feature of the transceiver (the transceiver must be turned off separately). Either connection is usually available in the vehicle fuse block if the red transceiver wire is terminated with an appropriate lug.

#### • Requirements

Both the 70-1340 and 70-1440 transceivers are designed to operate from a 12 V DC negative ground automotive electrical system. Current drain of at least 10 A should be expected. Inspection of the vehicle is recommended prior to installation. A low battery or other electrical system defects may degrade transceiver performance.

## INSTALLATION

---

70-1340/1440

**CAUTION:** Check the voltage source before connecting the power cable. Too much voltage (above 16 V) can severely damage the transceiver.

Included with the trunk-mount transceiver is a 6 m power cable. The under-dash transceiver is shipped with a 2 m Power/Accessory cable. Each cable includes fused power leads for connection to vehicle electrical system. Because the transceiver chassis is connected to the negative (-) lead, DO NOT INSTALL THE TRANSCEIVER IN A POSITIVE GROUND VEHICLE. If the transceiver is used as a base station, the external AC-line-to-DC power supply must be adequately regulated and have sufficient current capacity.

### ANTENNA

The communications system component that can affect overall performance the most is the antenna. A good quality antenna designed to provide 50  $\Omega$  terminating impedance at appropriate transceiver frequencies is recommended. When adjusting the antenna, be sure to follow its manufacturer's instructions. A better quality SWR meter should be used to accurately measure minimum reflected energy.

### MICROPHONE HANGER

The hand microphone included with the transceiver has a button on its backside to mate with its hang-up clip. The clip must be mounted with three screws in a location convenient to the operator. Three 1/2" screws and three 3/4" screws, each requiring a 5/64" hole, are also provided.

An optional microphone hanger (model 70-2195) is available for use with the CTCSS option. This hang-up box may be installed in place of the microphone clip on both metallic or non-metallic surfaces.

### POWER ACCESSORY PLUGS

#### • Under-dash

A 9-pin male Molex connector and a fused, 2 m power cable assembly, P/N 70-2211B, mates to the power/accessory connector (J415) on the rear of

the 70-1340. Extra pin positions are used for connection of optional devices not included with this assembly.

Optional devices can be connected to the Power/Accessory Plug by inserting Molex pins included with these devices into their respective vacant holes. See Figure 3 - 1. Option connections are shown in lighter shade.

#### • Trunk-mount

The 70-1440 has two 9-pin male Molex receptacles—J415 on the trunk unit; J324 on the Control Head. The trunk unit receptacle mates to the 70-2212B Power Cable assembly. The Power Cable includes an in-line fuse in its 6 m power leads and a jumper between pins 5 and 6 that routes speaker audio to the control head.

The 9-pin Accessory Plug connects to the rear of the control head. The speaker has Molex pins that insert into this plug. Extra pin positions are present for connection of the optional 70-2195 switching hang-up box (not included with the standard transceiver) for use with CTCSS or CDCSS. Two more pin positions are provided for optional auxiliary connections. See Figure 3 - 2.

### EXTERNAL SPEAKER

#### • Under-dash (Model 70-2355)

Normally, the transceiver internal speaker is connected to receive audio by the jumper to pins 5 and 6. If one of the MIDLAND external speakers is to be utilized, the jumper must be removed to disable the internal speaker and the two wires from the external speaker must connect to pin 4 and 6.

**NOTE:** If the 70-2355 15 W External Speaker is to be connected, its input cable center conductor (white) must be connected to pin 6, and the shield (black) to pin 4.

#### • Trunk-mount

The 70-2355 15 W speaker comes with the standard trunk-mount transceiver configuration. It connects to the Control Head Accessory Plug. Its 5 1/2' cable

is terminated with appropriate Molex pins for insertion into the trunk-mount Accessory Plug on the Control Head or the under-dash Power/Accessory Plug. The speaker housing and mounting bracket assembly is 5" x 5" x 3", and the mounting surface is 4 1/4" x 1 1/4", with four 3/32" screw slots.

## HANG-UP BOX

If the CTCSS feature is included in the transceiver, the optional 70-2195 Microphone Hang-Up con-

tact/switch-box is installed to unmute CTCSS squelch when the microphone is lifted. The center conductor of the shielded hang-up box cable connects to pin 3, the shield to pin 2.

## AUXILIARY DEVICES

Pins 1 and 8 are available for auxiliary connections necessary with certain optional features. Wiring details for these are found in the literature for the option.

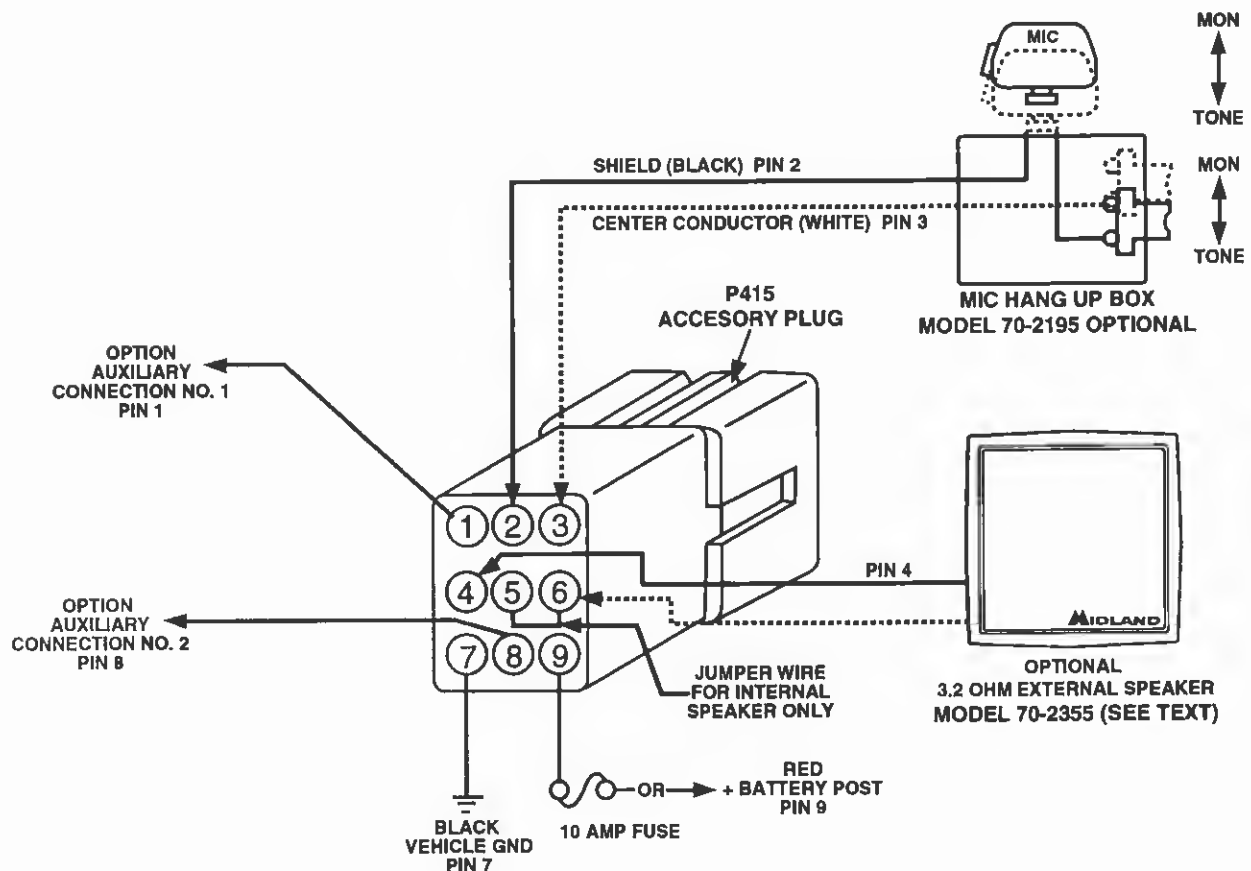


Figure 3 - 1 Under-Dash — Power/Accessory Plugs

# INSTALLATION

70-1340/1440

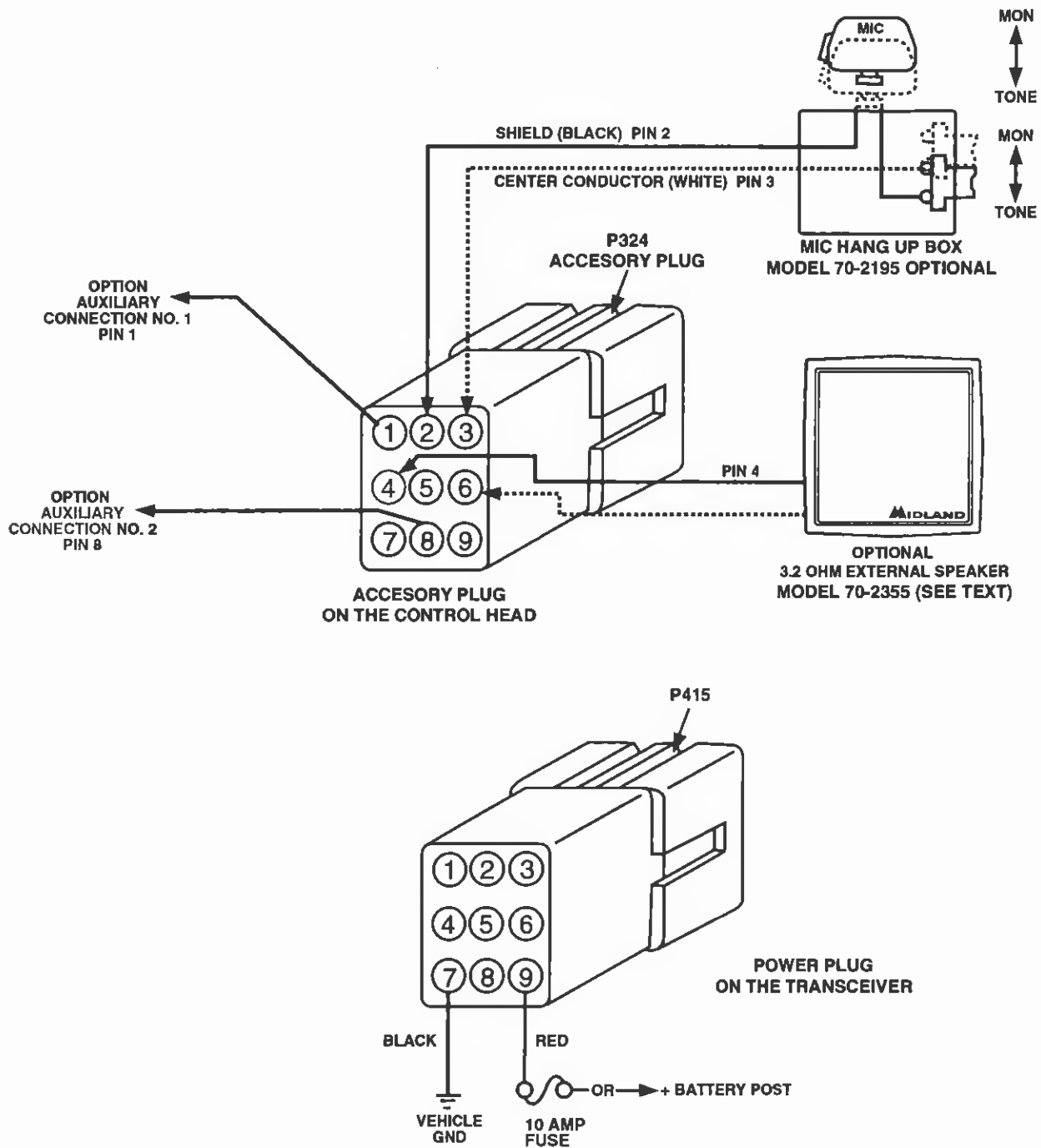


Figure 3 - 2 Trunk-Mount — Power and Accessory Plugs

## **SECTION 4**

## **SERVICING**

## SERVICING

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70-1340/1440

### NOTES



## REMOVING THE TR-1517 BOARD

When servicing the XTR or adding option kits, you may need to remove the TR-1517 Board. To do so:

1. Unscrew and remove the bottom cover.
2. Unplug J401 and J411 (for Trunk-Mount units, unplug J414 as well).
3. **Under-Dash Units:** Insert a screwdriver in the slot located on the Control Head above J411 and IC402 of the TR-1517 Board (see **Figures 4 - 1a and 4 - 1b**). Pry up, then tilt the bottom part of the Control Head away from the radio chassis.

**Trunk-Mount Units:** Remove the two screws securing the Nose-Piece (located in the handle), and pull it off.

4. Snap off the PA Module and VCO/Reference Oscillator shield covers.
5. Loosen the nut on Antenna Jack J501.
6. Remove the eighteen screws securing the TR-1517 Board (notice that three of the screws in the PA Module are longer than the rest).
7. Remove the three clips holding IC401, IC402, and IC406 to the front of the radio.
8. Lift the front part of the TR-1517 Board up from the radio, and unclip Power Plug J415. Finish lifting the board out of the radio.

The TR-1517 Board is now ready for servicing.

After servicing, reinstall the board by following the following steps:

1. Insert J415 through its hole and reattach it to the radio.
2. Lower the board back into the radio (make sure all wires are on top). The plate on J501 goes on the outside of the radio.
3. Insert the three long screws into their proper positions in the PA Module (see **Figures 4-1a and 4-1b**). Then insert the fifteen remaining screws.
4. Tighten the eighteen screws. Do not over-tighten.
5. Tighten the nut on J501. Check the solder connection on J501. Reflow solder if needed.
6. Replace the clips for IC401, IC402 and IC406. Replace the connector plugs into J401 and J411 (for Trunk-Mount Units, also replace the brown connector plug into J414--notice that the white connector plug is not used).
7. Replace the cover shields for the VCO/Reference Oscillator and PA Module. Make sure that you don't clamp the wires under the covers.
8. Replace the Control Head (or Nose-Piece for Trunk-Mount Units).
9. Replace the bottom cover.

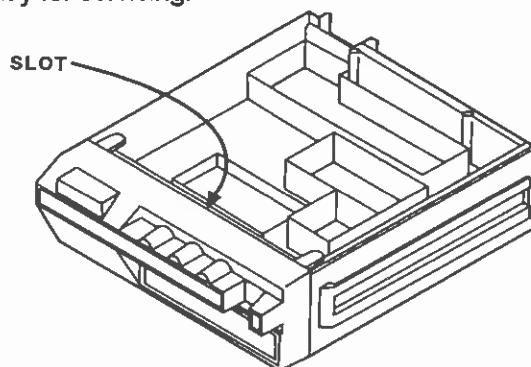


Figure 4 - 1a — SYN-TECH XTR Chassis and Control Head

# SERVICING

70-1340/1440

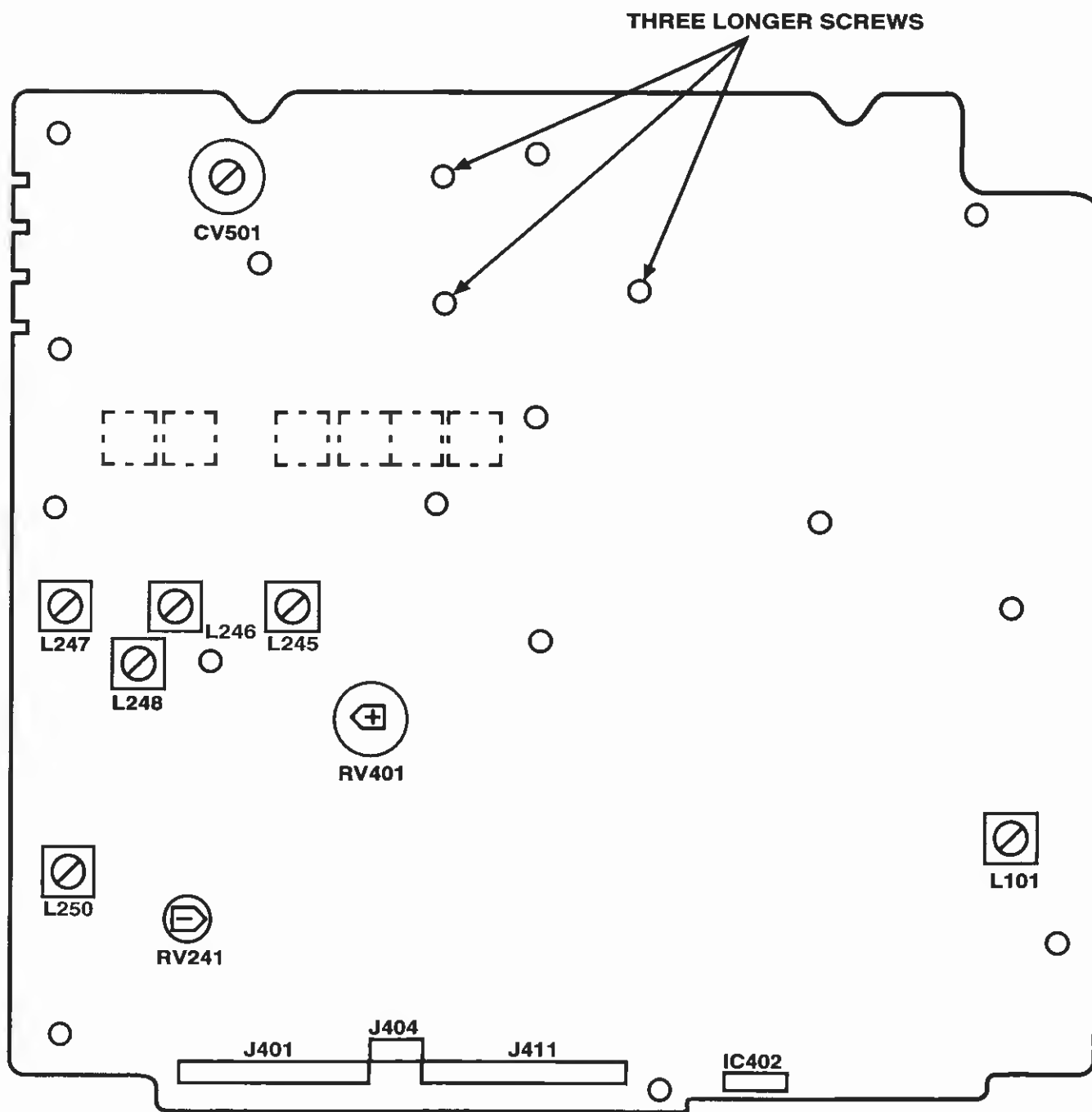
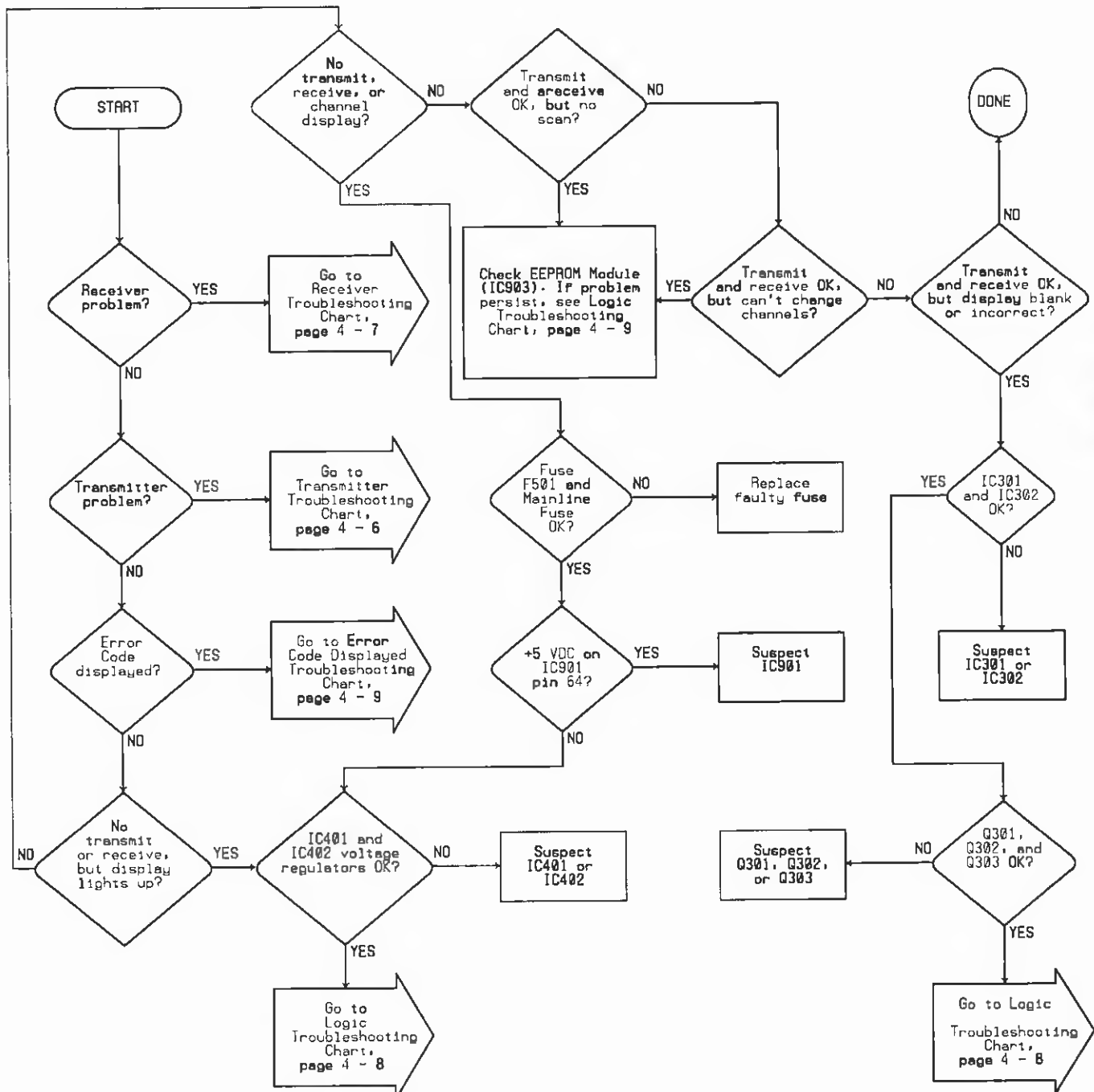
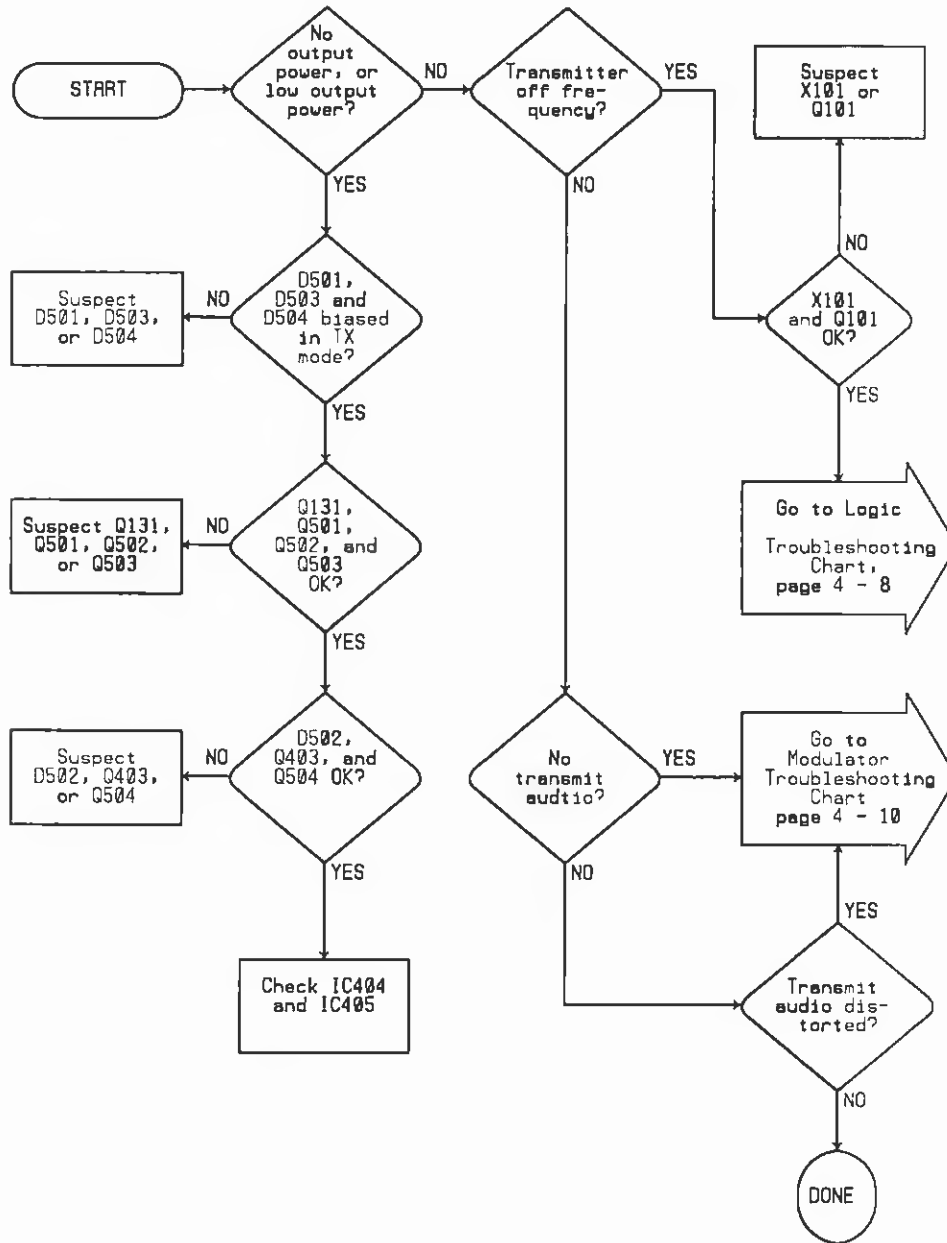


Figure 4 - 1b — TR-1517 Board

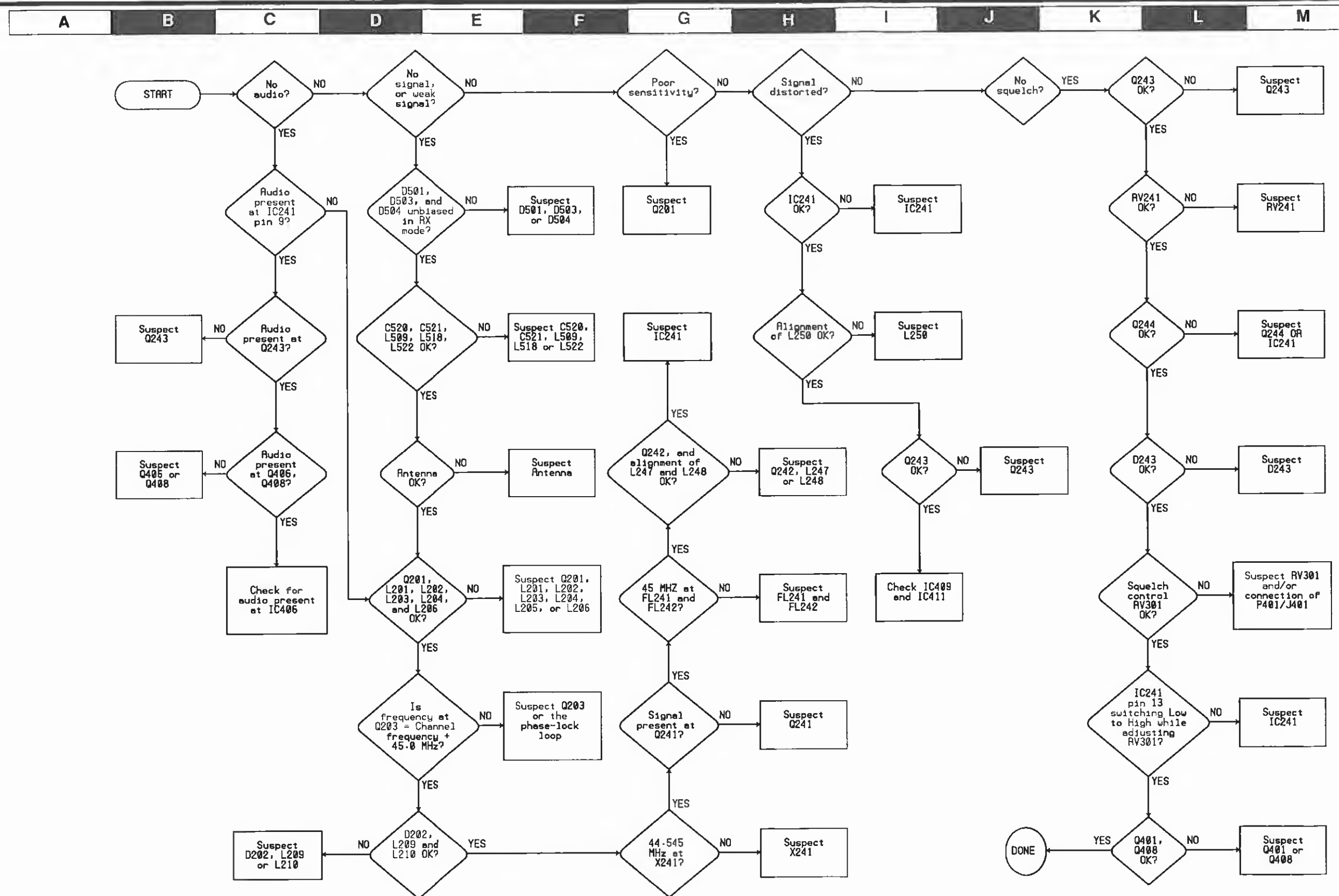
## TROUBLESHOOTING CHARTS



Troubleshooting Chart 4 - 1 — Getting Started

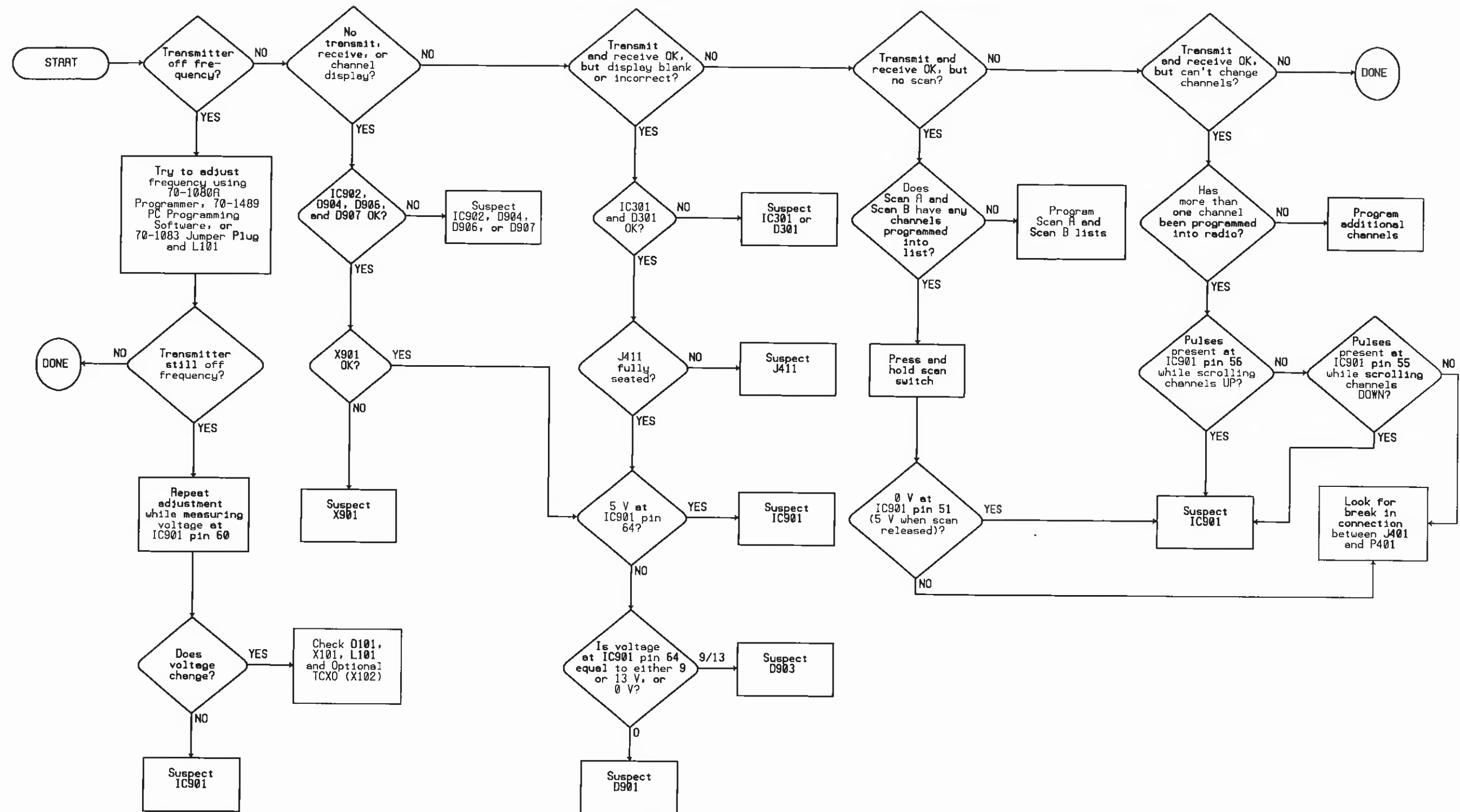


Troubleshooting Chart 4 - 2 — Transmitter Problem

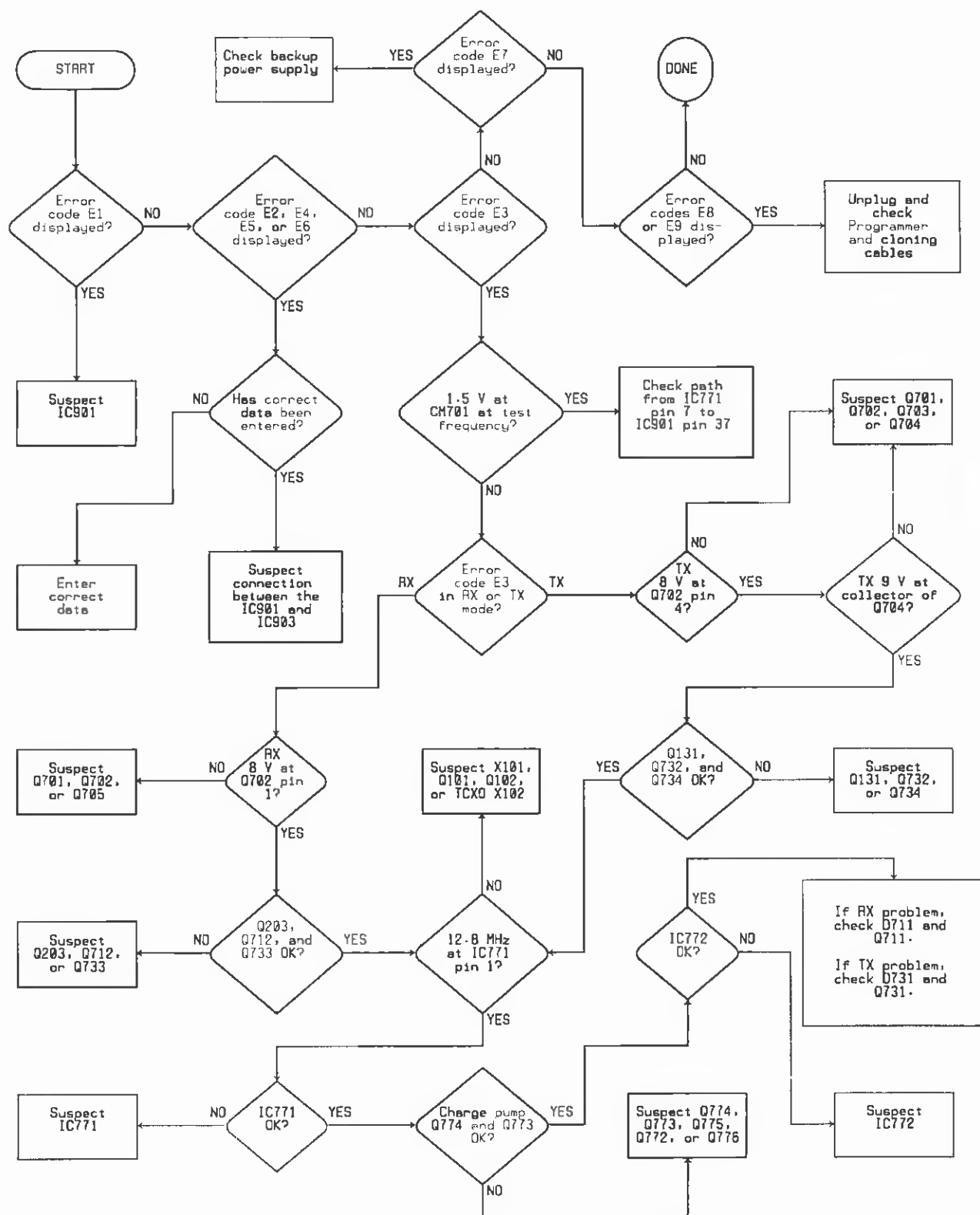


Troubleshooting Chart 4 - 3 — Receiver Problem

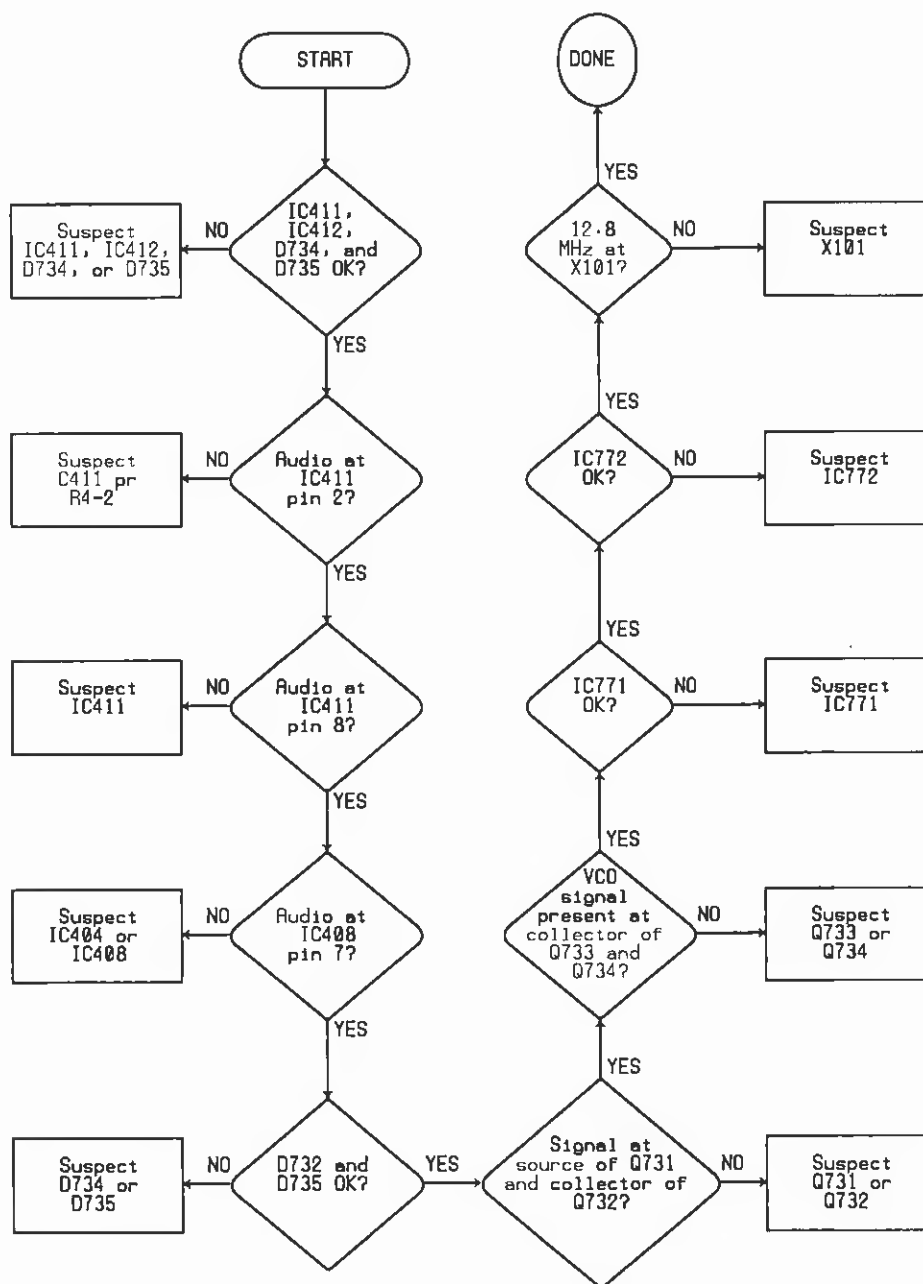
A	B	C	D	E	F	G	H	I	J	K	L	M
---	---	---	---	---	---	---	---	---	---	---	---	---



Troubleshooting Chart 4 - 4 — Logic Problem



Troubleshooting Chart 4 - 5 — Error Code Displayed



Troubleshooting Chart 4 - 6 — Modulator Problem



## **COMPONENT REPLACEMENT**

### **STATIC POTENTIALS**

Many of the transceiver components are susceptible to higher voltages whether they are in or out of a circuit. Avoid static or AC-line potentials when handling components and circuit boards. Prevent damage from electrically "hot" tips that carry AC-line or static potential by using a grounded soldering iron.

The only way to alleviate risk of component damage from static discharge is to make sure all of the objects that touch the circuitry during component replacement carry the same potential. Since the soldering iron is grounded, everything else must be grounded: the bench, the equipment being worked on, and you. There usually isn't a need to wire yourself to your bench unless you work on carpeting on dry-air days. Just touch bench ground when you sit down so that you and the grounded work area are at the same potential.

### **REPLACING CHIP CAPACITORS AND RESISTORS**

This section describes the best way to remove a chip component and install a new one. Chip components do not have leads, just metallic film on end-surfaces to solder to. Often the surface is tinned with solder. Because the metallic film can be easily damaged by contamination and excessive heat, these components must be soldered very carefully. No chip component can be unsoldered, then resoldered without damage. Always discard a used component.

- **ITEMS REQUIRED:**

- Grounded temperature-controlled soldering iron with a 1/32 inch flat-blade tip. The tip temperature must be maintained at approximately 600 degrees Fahrenheit.
- 60/40 electronics-grade solder, 22 gauge or thinner, with rosin flux.
- Tweezers or longnose pliers.
- Thin desoldering-wick.
- Isopropyl alcohol or equivalent for solvent.
- Rosin solder-flux. DO NOT USE ACID FLUX.

## SERVICING

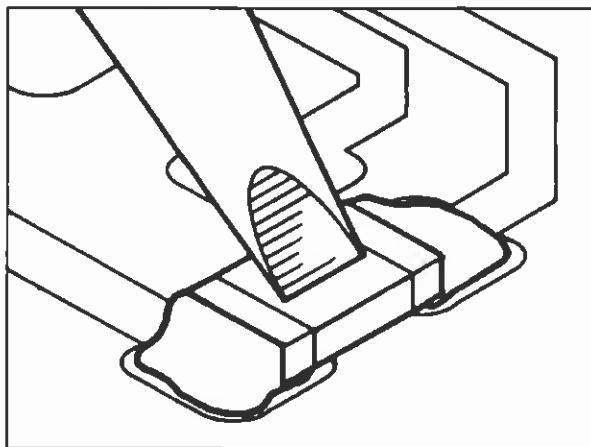
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70-1340/1440

- **PROCEDURE:**

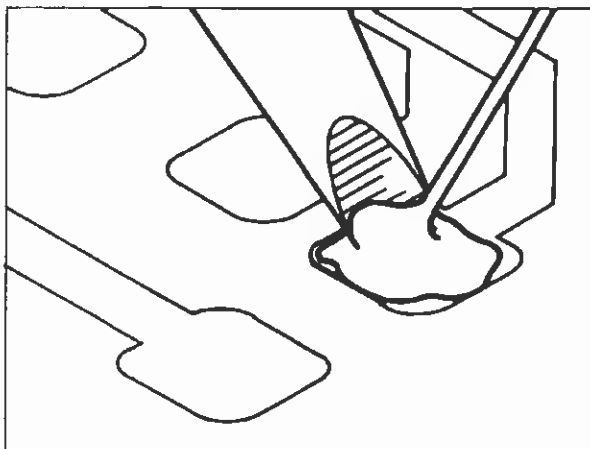
1. Place the solder iron tip directly on the defective component to melt the glue under the component, then solder as shown in **Figure 4 - 2**. Remove the component with tweezers or longnose pliers. Discard the component.

**CAUTION:** Application of too much solder can create solder bridges between PC patterns under the soldered component and around the pad.



**Figure 4 - 2**

2. Completely remove old solder, old glue, and any other contaminants from the area with desoldering-wick and solvent.
3. Apply only enough fresh solder to coat the clean PC pad as shown in **Figure 4 - 3**.



**Figure 4 - 3**

4. Place component and briefly heat the new solder and pad while holding the component with tweezers. Do not touch the new component with the iron. Only heated solder should touch the component to make a light "tack" bond to it. See Figure 4 - 4.

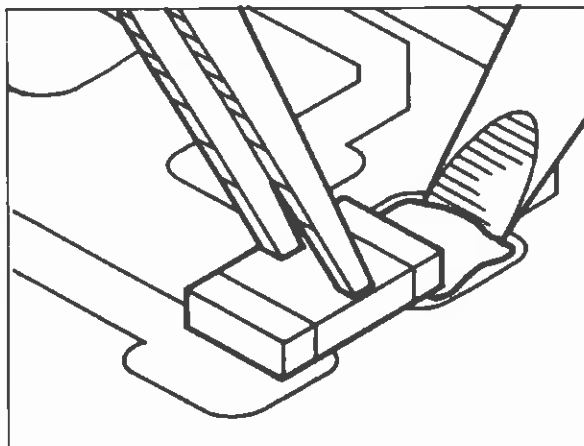


Figure 4 - 4

5. With one component end tacked to hold it, the other end can be soldered. Carefully apply heat to the PC pad while adding only enough fresh solder to produce a clean fillet as in Figure 4 - 5—do not apply too much solder, otherwise it may flow underneath and short the pads together. Let the hot solder flow onto the component—do not touch the component with the iron. Repeat to finish the other end of the component. Solder must adhere to all metallic end-surfaces on both ends as shown in Figure 4 - 6.

**CAUTION:** Avoid direct contact to the chip component with the iron tip. Too much heat and contamination will break down the metallic film on component ends resulting in loss of internal connection (a capacitor is comprised of several wafer plates that connect through the metallic end-surfaces). If satisfactory solder adhesion does not occur, the metallic end surface has been damaged and the chip component should be replaced again. More soldering will only damage the component further.

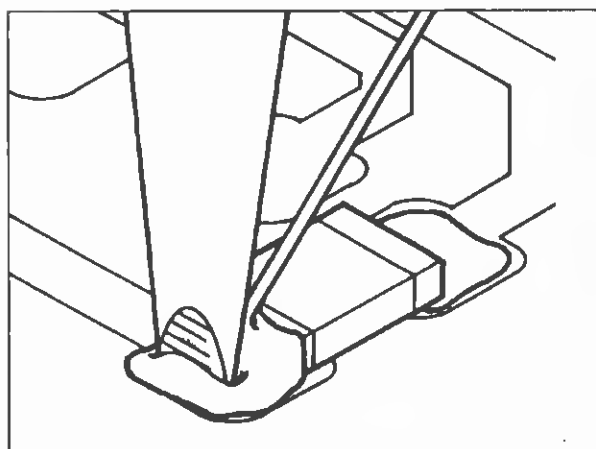


Figure 4 - 5

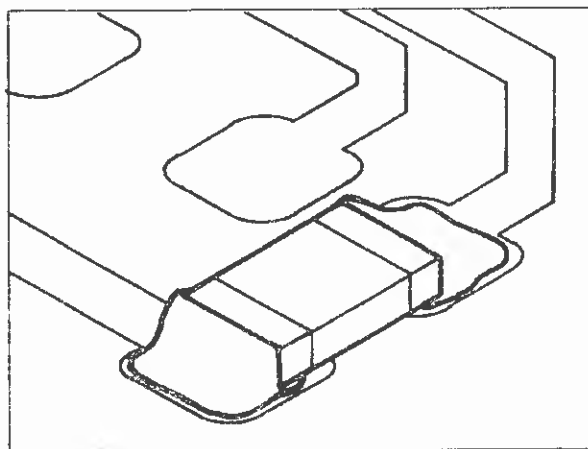


Figure 4 - 6

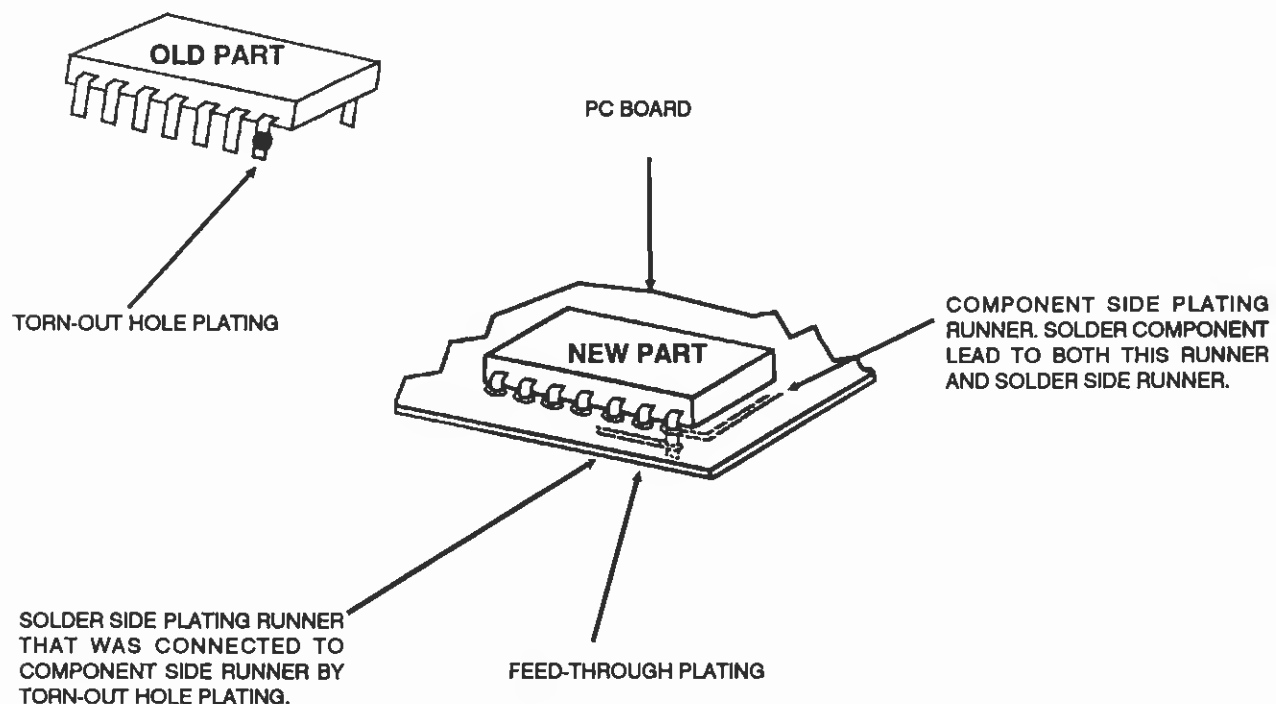
**REPLACING COMPONENTS WITH FEED-THROUGH LEADS**

Exercise extreme care when replacing components with leads that feed through a PC board. The copper plating on both sides of the printed circuit board and inside component lead holes easily separates and tears from the PC board when heated.

Use a solder suction tool or braided desoldering-wick to remove solder from component leads, one at a time. Solder must be removed carefully and thoroughly so that the IC can be pulled without resistance. After removing as much solder as possible, use a dental pick or straight-pin to break the

leads loose from the inside of the cleaned-out hole. Cutting the defective components away from its leads first makes removing the leads and solder easier.

Before installing a new component, remove all solder from lead holes and make sure the device is oriented properly. Always inspect old part leads for any feed-through plating rings that may have been pulled out of holes. The plating may have completed a circuit. If so, make sure the corresponding lead of the new component is soldered to plating runners on both sides of PC board as shown below.

**Figure 4 - 7**

## ELIMINATING RADIO INTERFERENCE

Occasionally, you must contend with interference from somewhere in the automobile. Interference problems are solved by understanding the interference and its path into the transceiver, locating its source logically, then eliminating it in the simplest way available.

Interference may be conducted into the transceiver directly, or induced into it, or both. Conducted interference passes through the DC power leads or the accessory wiring of the radio. Radiated interference, which can originate from anywhere in the vehicle, simply produces noise voltages on conductors inside the radio or its antenna. See **Figure 4 - 8**.

Conducted interference is simple noise voltage present in the vehicle electrical system. With many electrical devices turning on and off in a vehicle, current spikes produce voltage drops across wire resistances, causing voltage transients to appear throughout the electrical system. Connecting the radio power leads to this noisy electrical system applies the noise voltage directly to the radio. Most noise voltage is attenuated by power-line filters within the radio; but spikes that are severe enough may become audible.

While interference conducted through power leads affects only transceiver audio circuitry, induced interference often invades the receiver through the antenna by imitating receiver IF frequencies or channel frequencies. Induced interference occurs when an electromagnetic field penetrates the radio. If an electromagnetic field is strong enough, it can induce noise currents on the radio accessory and power wiring.

### IDENTIFYING THE INTERFERENCE

The first step toward eliminating interference is to identify and characterize it. Listening to the noise can reveal a lot. For example: if the noise heard varies with engine speed, its source must relate to the engine, such as the alternator, ignition system, or tachometer.

Because you are dealing with frequency-modulated equipment, determining if the noise is at receiver-

sensitive frequencies is easy. With all squelch circuits open, simply apply an unmodulated signal to the transceiver that is strong enough (10 mV at the Antenna Jack) to overcome any high frequency noise signal that could invade below. If noise remains, interference is at low frequencies that can enter only by proximity coupling to radio wiring or direct conduction.

Next, power the radio with an independent 12 V power source (such as another car battery). Isolate by moving wiring and/or the radio while listening for changes in the noise level. If the noise stopped when you connected the independent power source, noise voltages are conducting through on the positive circuit or the ground (see **ELIMINATING CONDUCTED NOISE**).

### ELIMINATING CONDUCTED NOISE

If noise voltage is present on the power leads, there may be defective equipment in the vehicle electrical system that needs repair. An alternator with a bad diode has a large current ripple on its output, which produces a whine in the transceiver that varies in pitch with engine speed. Its current capacity is limited, but vehicle operation will not be noticeably impaired. Lights that dim during large current demands are a good sign of such a defect.

Another possible source of conducted interference is a fan motor in the same circuit to which the radio is connected. Because a fan also induces interference, confirm that noise is conducted into the radio (see **IDENTIFYING THE INTERFERENCE**). If the interference is conducted into the DC power leads of the radio, find a power connection point in the electrical system for the transceiver that is further from the fan circuit.

Noise voltages can also be added to the radio DC power input via the ground path. This is a condition where a high, noisy current shares the ground path of the radio equipment. For example:

Ground current of a fan motor finds its way to the vehicle battery through segments of metal body A-frame assemblies (see **Figure 4 - 9**). If the

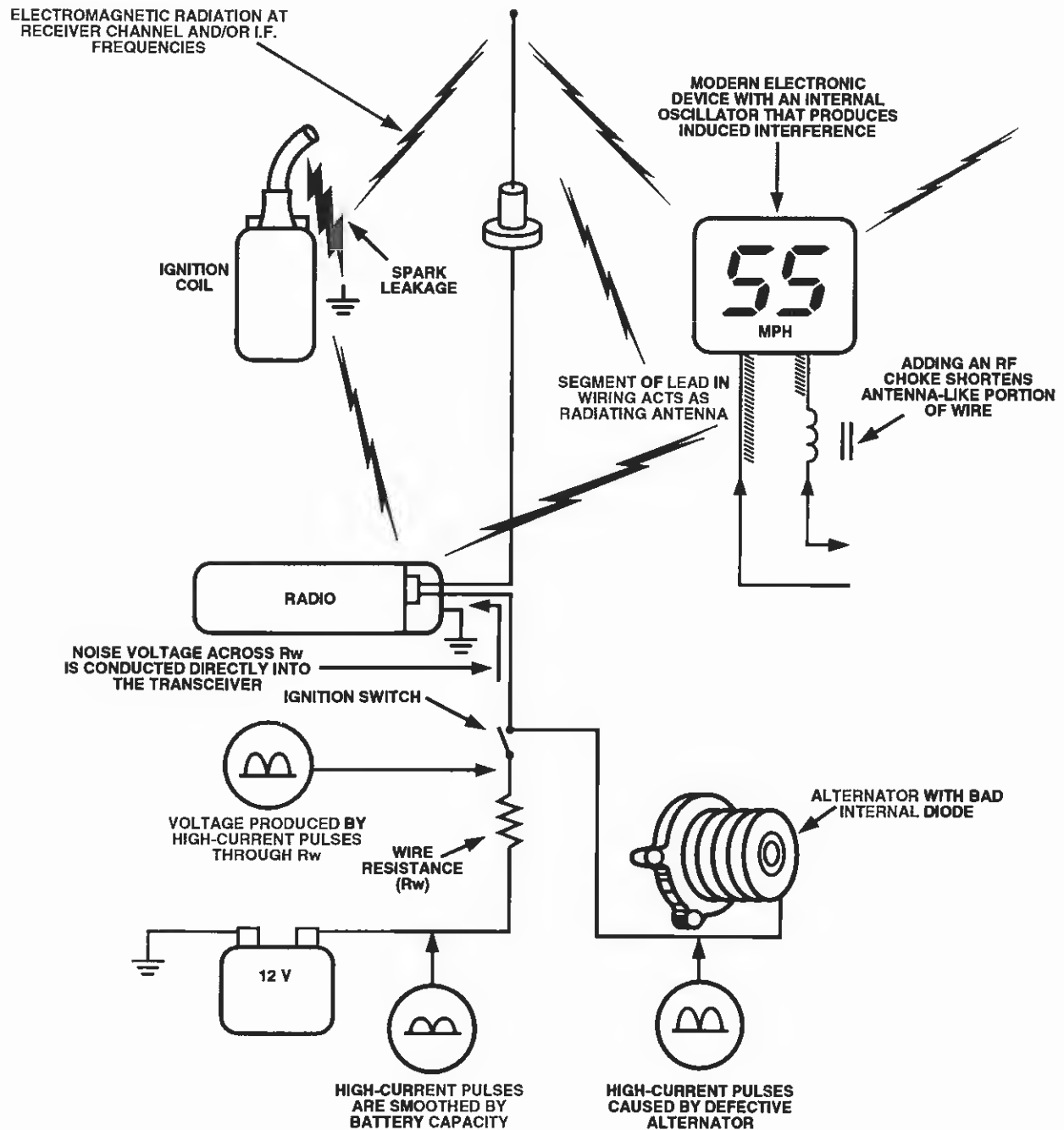


Figure 4 - 8 — Interference Paths

electrical bond between two parts is weak, and the radio ground current must also travel through this weak joint, a voltage drop induced across the joint by the fan current will appear at the radio power plug.

To avoid a noisy ground, connect radio ground closer to the vehicle battery.

## **ELIMINATING RADIATED INTERFERENCE**

If DC power source substitution proves interference is not conducted into the power leads, two likely sources of radiated interference are sparks and high frequency oscillators. Modern vehicles use many electronic accessories and systems that may produce a hash or whine in the transceiver. Oscillators within these devices, which sometimes are poorly shielded, may radiate an electromagnetic field at frequencies many multiples of the oscillator frequency.

Again, listen to the noise to learn about its source. Unless the interfering automobile accessory is part of engine operation, the noise won't vary with engine speed. The interfering accessory can be isolated by temporarily removing power to it and checking for absence of noise.

Because the lead-in wires of an automobile device can become radiating antennas, induced interference is more often radiated from the automobile accessory wiring than the accessory itself. Such interference can be inductively coupled into nearby radio power and accessory wiring or radiated toward the antenna.

Check that the radio wiring does not run next to, nor parallel with, vehicle wiring. Move the wiring to identify and/or solve this problem.

If necessary, RF chokes can be connected in series with the "hot" lead-in wires of the interfering device, close to its housing to kill the antenna effect. Usually, "hot" wires can be identified if the noise volume changes with wire movement.

Radiated interference may also enter through the antenna. This can be verified by substituting the antenna and its cable with a 50 ohm RF dummy load and short cable. The dummy load is necessary to

properly balance the receiver input and give comparable results. If the noise stops, interference was entering the antenna. The only way to solve this sort of interference problem is to eliminate radiation at the source with RF chokes as described above. Sometimes, positioning the antenna further from the interfering accessory may help.

## **ELIMINATING INTERFERENCE FROM SPARKS**

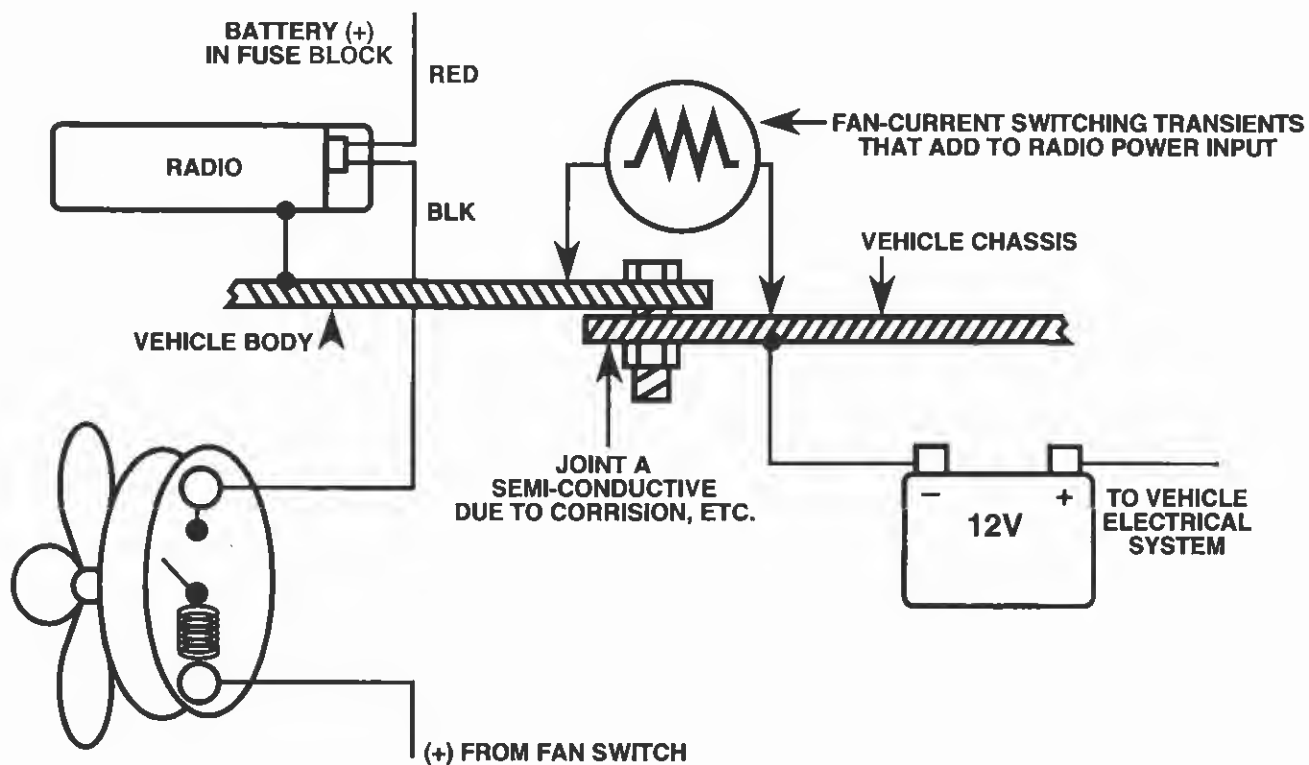
Sparks produce electromagnetic energy over a large area of the RF spectrum. This energy usually invades the receiver input through the antenna. Therefore, the problem must be resolved at the source.

Modern vehicles use higher voltage ignition systems. As a result, electrical leakage occurs more easily through cracks and contaminants. If the interference produces a buzz while the engine is idling, and the buzz increases in pitch with engine speed, sparks are leaking to ground before distribution to the spark-plug wires. Check the ignition coil, its high voltage wire, and distributor cap for signs of arcing through cracks and burns or over dirt.

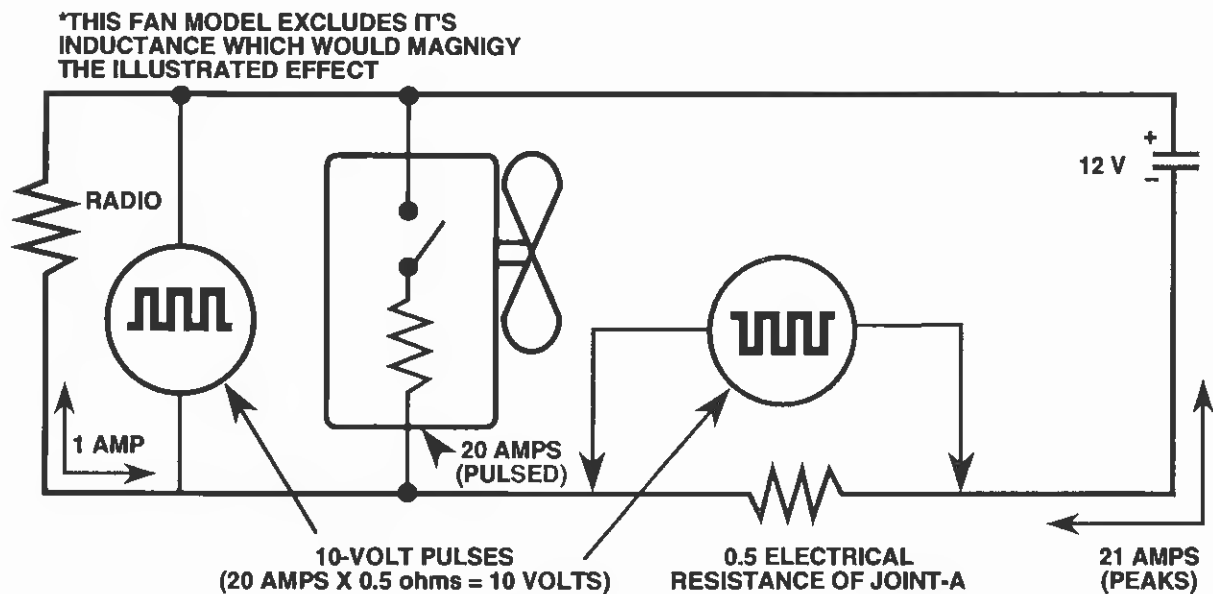
If the interference produces a repetitive popping sound while the engine is idling, and it increases in rate with engine speed, a single spark plug or wire are suspect. Check the distributor cap, spark plug wires, and spark plugs for cracks, burns, and dirt.

Spark plug and ignition coil wires in modern vehicles are made with suppressive (resistive) conductors to reduce electromagnetic radiation. This may not be the case in older vehicles. Check with an ohmmeter.

Interference from sparks made by fan motor brushes produces a whine that varies with fan speed. Badly worn brushes or bearings cause excessive sparks, and you may need to replace them. A 0.1 uF coaxial capacitor can be connected to the positive lead as close to the motor as practical to reduce radiated interference. The capacitor body must connect securely to the grounded motor housing.



## GROUND PATH



## EQUIVALENT CIRCUIT

Figure 4 - 9 — A Nolsy Ground



## POTENTIAL SPUR FREQUENCIES

Harmonics of oscillator and prescaler circuitry within the 70-1340/1440 may fall within the receiver bandwidth when programmed for certain frequencies. Note that these are potential problem frequencies only; your unit may not be affected. If receiver quieting or interference is found on these frequencies, it can usually be eliminated by installation of a first local oscillator inverse injection kit.

### Possible Spur Frequencies — High Side Injection (Standard)

A-Band	B-Band
137.810 MHz	150.000 MHz
147.000 MHz	160.710 MHz
150.000 MHz	163.930 MHz

### Possible Spur Frequencies — Low Side Injection (Optional)

A-Band	B-Band
136.406 MHz	151.667 MHz
137.903 MHz	153.333 MHz
139.355 MHz	155.769 MHz
141.000 MHz	157.500 MHz
142.500 MHz	160.200 MHz
144.310 MHz	162.000 MHz
145.862 MHz	165.000 MHz
147.857 MHz	166.875 MHz
149.464 MHz	170.200 MHz
151.677 MHz	172.174 MHz
153.333 MHz	
155.769 MHz	
157.500 MHz	

## DC VOLTAGE CHARTS

Table 3 - 1 — Transistors (In V DC)

REF NO.	TYPE	MODE	BASE	COLLECTOR	EMITTER	FUNCTION
Q101	2SC2620	TX/RX	3.1	4.8	2.6	CRYSTAL OSCILLATOR
Q102	2SC2462LC	TX/RX	3.2	4.7	2.6	BUFFER AMP
Q131	2SC3357	TX	0.9	7.6	0.7	TX-PREAMP
Q201	2SC3356	RX	0.9	7.2	0.1	RF AMP
Q203	2SC3357	RX	0.7	6.2	0.5	INJECTION AMP
Q243	2SC2462LC	RX	3.1	9.1	2.2	AUDIO PRE-AMP
Q244	2SC2462LC	RX	2.4	4.3	1.7	60 kHz AMP
Q301	2SA1121C	TX/RX	4.4	3.4	5.0	DIMMER CONTROLLER
Q409	2SC2462LC	TX/RX	8.8	9.0	8.2	RIPPLE FILTER
Q410	2SC2462LC	SQ	4.8	5.0	4.1	LED SWITCH
		UNSQ	0.0	5.0	0.0	
Q501	2N4427	TX	0.6	5.4	0.0	PRE-DRIVER
Q502	2SC1971S	TX	0.0	12.6	0.0	DRIVER
Q503	MRF247	TX	— —	12.6	0.0	FINAL
Q504	2SB10650	TX	12.5	5.4	13.6	CURRENT REGULATOR
Q701	2SC2462LC	TX/X	9.0	9.1	8.2	RIPPLE FILTER
Q712	2SC2351	RX	1.6	7.0	0.9	BUFFER AMP
Q732	2SC2351	TX	1.6	7.6	0.4	BUFFER AMP
Q733	2SC2351	TX/RX	1.8	8.3	1.3	SYNTH BUFFER AMP
Q734	2SC2351	TX	1.8	8.2	1.3	SYNTH BUFFER AMP
Q773	2SC2618	TX/RX	0.0	— —	0.0	CHARGE PUMP
Q774	2SA1121SC	TX/RX	9.0	— —	9.0	CHARGE PUMP
Q775	2SA1121SC	TX/RX	9.0	9.0	9.0	CHARGE PUMP
Q776	2SC2462LC	TX/RX	0.0	0.0	0.0	CHARGE PUMP

Table 3 - 2 — FET's (In V DC)

REF NO.	TYPE	MODE	GATE 1	GATE 2	DRAIN	SOURCE	FUNCTION
Q241	2SK125	RX	0.0	— —	9.0	2.2	FIRST IF AMP
Q242	2SK360E	RX	0.0	— —	9.0	0.52	FIRST IF AMP
Q408	2SK508	SQ	0.0	— —	5.0	5.0	SWITCH
		UNSQ	4.7	— —	5.0	5.0	
Q711	3SK151GR	RX	3.4	4.7	7.8	3.0	RX VCO
Q731	3SK151GR	TX	3.4	4.7	7.8	3.0	TX VCO

Table 3 - 3 — Transistor Packs (In V DC)

REF NO.	TYPE	MODE	PIN NUMBER					
			1	2	3	4	5	6
Q302	IMH1	RX	0.0	5.0	0.0	0.0	5.0	0.0
Q303	IMH1	RX	0.0	5.0	0.0	0.0	5.0	0.0
Q401	IMX2	TX/RX	0.1	0.7	7.6	0.0	0.0	0.0
Q403	IMZ1	TX/RX	13.1	9.1	6.4	0.0	0.0—5.0	0.0—4.3
Q702	IMB3	RX	7.6	0.0	0.0	0.0	0.0	8.2
		TX	7.6	0.0	7.5	7.5	8.0	8.2
Q703	IMH1	RX	0.0	0.0	0.0	9.0	4.6	0.0
		TX	2.9	2.9	0.0	0.0	0.2	0.0
Q704	IMB3	RX	0.0	9.0	9.1	0.0	8.0	8.1
		TX	8.2	0.0	9.1	7.8	0.7	8.3
Q705	IMH1	RX	0.0	4.6	0.0	0.0	3.3	0.0
		TX	0.0	0.0	0.0	8.3	3.3	0.0
Q771	IMD1	TX/RX	4.6	4.6	4.6	4.6	4.6	0.0
Q772	IMH1	TX/RX	0.0	4.6	4.4	9.0	4.6	0.0
Q778	IMH1	TX/RX	4.6	4.6	0.0	0.0	0.0	0.0

# SERVICING

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**Table 3 - 4 — Integrated Circuits, 8 Pins or Less (In V DC)**

REF NO.	TYPE	MODE	PIN NUMBER							
			1	2	3	4	5	6	7	8
IC401	AN6541	TX/RX	13.5	0.0	9.1	—	—	—	—	—
IC402	HA17805WP	TX/RX	13.5	0.0	5.0	—	—	—	—	—
IC405	BA728F	TX/RX	0.9	2.8	2.8	0.0	4.1	4.1	3.3	9.0
IC406	TDA7240A	RX	6.5	6.5	6.4	0.0	6.0	13.5	6.5	—
IC408	AN5262	TX	4.0	0.0	8.3	0.0	1.3	9.1	3.6	—
IC409	AN5262	RX	4.0	0.0	0.0	0.0	1.3	9.1	3.6	—
IC412	F188A3120	TX	2.3	0.0	2.5	5.0	—	—	—	—
IC903	M6M8002IL	TX/RX	0.0	0.0	0.0	8.2	—	1.2	9.1	3.6
IC902	MN1280R	4.9	4.9	0.0	—	—	—	—	—	—

**Table 3 - 5 — Integrated Circuits, 8 to 16 Pins (In V DC)**

REF NO.	TYPE	MODE	PIN NUMBER							
			1	2	3	4	5	6	7	8
IC241	MC3361P	SQ	6.7	6.0	6.6	6.8	6.4	6.4	6.4	6.8
		UNSQ	6.7	6.6	6.6	6.8	6.4	6.4	6.4	6.8
IC302	MC14174B	TX/RX	—	—	—	—	—	—	—	0.0
IC404	TX/RX	MC14411P	4.7	8.5	9.1	0.0	0.1	4.8	0.0	0.0
IC411	uPC4741G	TX/RX	4.7	4.7	4.7	9.0	4.7	4.7	4.7	4.7
IC771	MB1504	TX/RX	2.3	2.3	4.7	4.7	4.6	0.0	4.7	3.2
IC772	BU4066FP	TX/RX	0.7	0.7	0.7	0.7	9.0	9.0	0.0	0.7

REF NO.	TYPE	MODE	PIN NUMBER							
			9	10	11	12	13	14	15	16
IC241	MC3361P	SQ	2.8	0.7	0.8	3.1	6.3	4.7	0.0	1.8
		UNSQ	2.8	0.7	0.8	3.0	0.0	3.0	0.0	1.8
IC302	MC14174B	TX/RX	—	—	—	—	—	—	—	5.0
IC404	TX/RX	MC14411P	8.5	9.1	0.0	0.2	0.0	9.0	—	—
IC411	uPC4741G	TX/RX	4.7	4.7	0.0	4.7	4.7	4.7	—	—
IC771	MB1504	TX/RX	0.0	4.8	0.1	—	—	—	4.6	3.5
IC772	BU4066FP	TX/RX	0.7	0.7	0.7	9.0	9.0	9.1	—	—

Table 3 - 6 — Integrated Circuit IC403, MB87079

PIN NO.	V DC	PIN NO.	V DC	PIN NO.	V DC	PIN NO.	V DC
1	2.5	8	0.0	15	1.7	22	2.6
2	2.5	9	0.0	16	0.0	23	2.6
3	2.5	10	0.0	17	2.5	24	2.5
4	2.7	11	4.7	18	2.5	25	2.5
5	2.5	12	0.0	19	2.5	26	2.5
6	2.5	13	0.0	20	2.5	27	2.5
7	2.3	14	1.7	21	0.0	28	2.5

**SERVICING**

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**NOTES**

## **SECTION 5**

### **CIRCUIT DECSRIPTIONS**

## CIRCUIT DESCRIPTION

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## NOTES



The SYN-TECH XTR TX/RX unit is made up of three major sections: the PA section, the RF section, and the Logic Section.

## 40-WATT PA SECTION

### • RF Power Amplifier

A PC-board stripline is utilized to match Q501-base terminal to the coax. RF impedance at Q501-collector is transformed by PC-board stripline to the base terminal of driver Q502 and the collector of Q502 is transformed to the base of Q503. RF impedance at the collector of final-stage Q502 is again transformed by PC stripline and fine tuned by CV501 match circuit impedance at RF-gate D501. L514-L517 and C515-C519 comprise the harmonic filter. R512 and R513 serve to drain static and other DC potentials from the antenna.

### • Antenna Gate

In receive mode, PIN-diodes D501 and D503, D504 are unbiased. The RF-signal path from the final-amplifier Q503 is then severed, and the impedance matching network consisting of L518, C520, C521, L509, and L522 routes signals from the antenna to the receiver input through 50 ohm coax at J501.

D501, D503, and D504 are biased on in transmit mode. The receiver port network (L518 etc.) is detuned such that it appears as a high impedance to the antenna, and D501 couples final amplifier output to the antenna at J501.

### • Automatic Power Control

A PC stripline ahead of the harmonic filter, and a thin PC runner adjacent to it, serve as a directional coupler. D502 rectifies a small RF sample that is developed across the thin runner: thus producing a DC voltage that increases with RF power traveling forward into the antenna. This power level sensing voltage is inverting input of the comparator IC405 pin 6. The reference voltage applied to the comparator IC405 pin 5 is fed from the D/A converter IC404 pin 4, of which command is controlled by the micro-computer via the 70-1080 programmer in alignment mode.

Output of the comparator IC405 is applied to Q504 via Q403, which is a current source that feeds primary DC, to the collector circuits of the predriver Q501.

The feedback loop, from the directional coupler to Q504 via the comparator input IC405 pin 6 holds RF output power at the constant level determined by the reference voltage of IC405 pin 5, which is initially adjusted using the programmer.

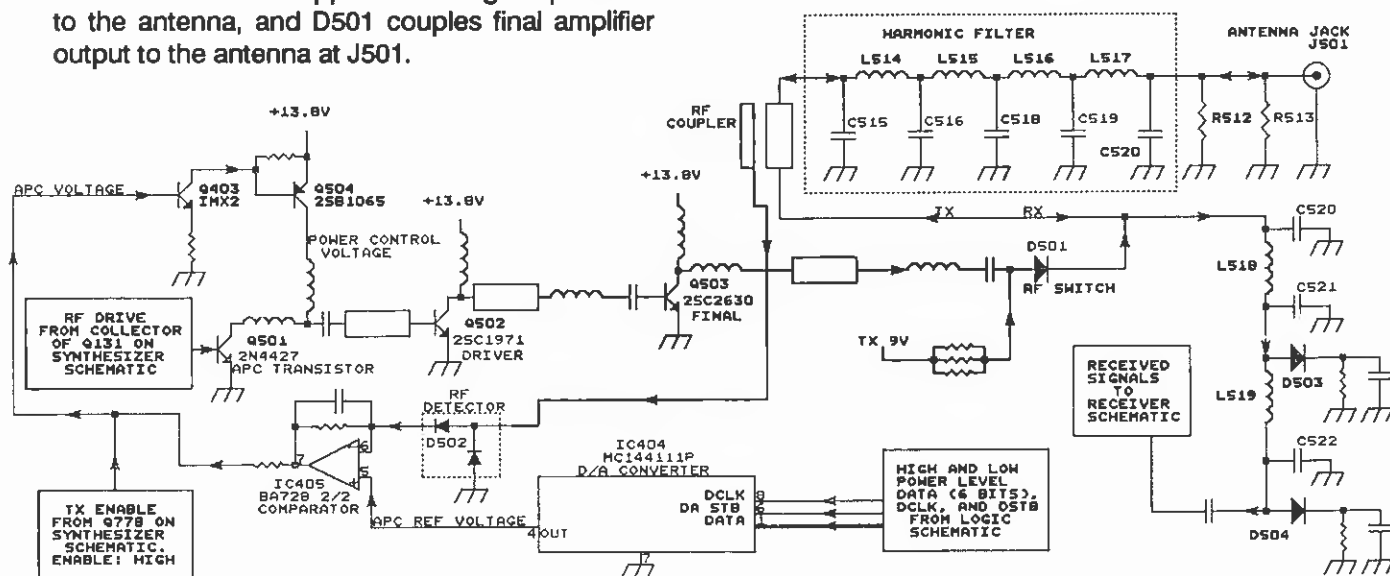


Figure 5 - 1 — 40-W PA Circuit (Simplified)

### RF SECTION

The RF Section consists of a frequency synthesizer, a transmit modulator, a receiver, and receive audio amplifier circuits.

#### SYNTHESIZER

Radio frequency signals for transmission and receiver injection are produced by voltage-controlled oscillators (VCO's) in a Phase-Lock Loop (PLL) configuration.

##### • Voltage Controlled Oscillators

In this radio, two VCO's are used — Q731 operates in transmit mode to generate transmit frequencies; Q711 operates in receive mode to generate receive injection frequencies. Each is buffered independently: by Q732 and Q712 respectively. Output of the buffers are amplified by Q131 and Q203 respectively. RF signal at receiver injection frequency ( $F_c + 45.0$  MHz) is applied from the LO amplifier Q203 in the receiver circuit. RF signal from Q131 is amplified further by the PA portion.

When the frequency of the VCO output drifts away from the desired value, the loop adjusts the steering voltage to compensate.

A single VCO tank can tune across the entire 24 MHz channel spread. Only one of the two (2) tanks is switched in at a time and they are selected by TXDL from the Logic portion. The microcomputer sets TXDL to logic low during transmit mode.

Resonance of each VCO tank is voltage-tuned by varactor diodes D711 and D731 respectively. Loop steering voltage applies reverse bias to all these varactor diodes simultaneously. As steering voltage increases, varactor diode capacitance decreases: thus, net capacitance in each tank decreases, which increases resonant frequency of the tanks.

##### • Loop Dividers

The amplitude of the VCO signal from Q733 collector for TX and Q734 collector for RX is sufficient to

feed prescaling frequency divider, IC771, which applies an output pulse to once every 64 or 65 input cycles. Additional frequency division is also performed within IC771 to produce 2.5 kHz. X101 is a temperature-compensated crystal oscillator that produces a reference frequency of exactly 12.8 MHz. The reference frequency is divided by IC771 to produce 2.5 kHz that is compared to the down-counted 2.5 kHz sample of VCO output. Normally the loop response is slowed enough by the active filter to block 5.0 kHz reference noise and prevent loop correction of voice modulation during transmit. Higher active filter rolloff frequency is selected by the microcomputer system on the Logic Board when the radio changes channels or it is keyed and unkeyed, by a logic low applied to the base of Q772. This increase in loop response speeds locking time.

A connection from an intermediate point in the phase/frequency comparator in IC771 is made at pin 7. When the loop is out of lock, the down-counted VCO sample is not in phase with the 2.5 kHz reference and low going pulses appear here, which produce a logic low at pin 7. This logic low is applied to Q778 and Q771 to switch to Q403-1/2 and Q504. Q504 then clamps off bias to transmit PA preamplifier Q501 to prevent emission of erratic signals generated by the uncontrolled VCO.

##### • Modulator

Voice signals from the hand-microphone are applied to audio filter IC411, where frequency response is pre-emphasized and splatter filtered. Gain is such that stronger signals bring IC411 into clipping, which limits modulation. Harmonics above the 3 kHz modulation pass-band are removed by the 2.5 kHz pi-network in IC411. Modulation signals are then adjusted by IC408 and IC404 so that modulation at limiting will produce transmitted carrier deviation of  $\pm 5$  kHz. Output of processed voice signals at IC411 pin 14 is fed to the gain control IC408, where the control voltage is fed from the D/A converter IC404 controlled by the command via the 70-1080A programmer.

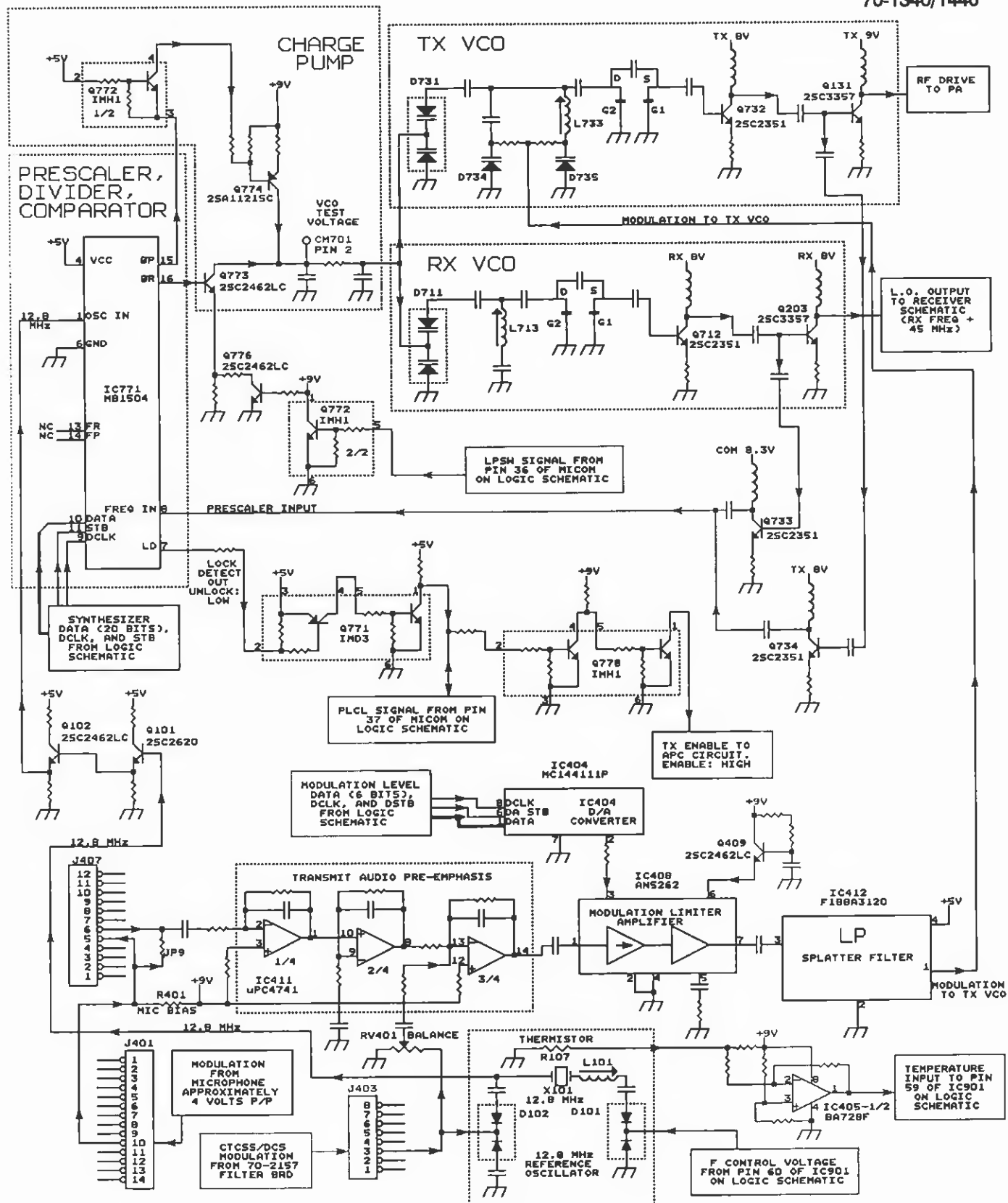


Figure 5 - 2 — Synthesizer Circuit (Simplified)

## CIRCUIT DESCRIPTION

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### RECEIVER

- **Preselector**

Through PIN-diode gates in the PA, RF signals are routed to the receiver input. Signals at image frequencies and frequencies far removed from the desired channel are rejected by a preselector comprised of six top-coupled, parallel tanks: L201, L202, L203, L204, L205, and L206. No tuning of these tanks is required for the entire 24 MHz channel frequency spread. Q201 provides adequate gain to overcome preselector signal losses and maximize receiver sensitivity.

- **Injection**

First Local Oscillator signal (channel frequency plus 45.0 MHz) is synthesized by the phase-lock loop and applied to Q203. A low pass filter is provided at the output of Q203; this rejects extraneous synthesized signals. No alignment for the first local oscillator signal is required.

- **First Mixer**

To maximize intermodulation immunity, a balanced configuration is utilized for the first mixer stage. High Injection is applied to L210-primary and preselector output is applied to its secondary center tap. A diode double balanced mixer using quad-diode D202 is employed. High injection is applied to the push-pull input of the mixer. Some this signal appears at mixer output, but most is lost because L209 is designed to operate at the 45 MHz first IF frequency.

- **First IF**

Mixer output is applied to Q241, which drives L244. L244 tunes to match the input impedance of 45 MHz monolithic crystal filter FL241. L246 matches the output of FL241 to the input of FL242. FL241 and FL242 reject signals outside the channel bandwidth. L247 matches the output of FL242 to the input of Q242. Q242 amplifies the first IF signal at least 20 dB, and it is coupled to second IF IC241 by L248.

IC241 contains all second IF circuitry, a quadrature demodulator, and a threshold gate. X241 and cir-

cuitry in IC241 generate second LO injection 44.545 MHz. A double-balanced mixer, that cancels both input signals internally is utilized so that additional tuned circuits at its output are not needed. Mixer output signal of 455 kHz (IC241-3) is band-pass filtered further by FL243 and FL244 then superamplified (100+ dB) by the second IF amplifier/limiter within IC241 (pin 5).

- **Demodulation**

The quadrature detector in IC241 is another double-balanced mixer to which limiter output is applied. Its second input is taken from 455 kHz tank L250 that is also fed with limiter output (IC241-pin 7). Frequency deviation from carrier center will cause phase difference between the two demodulator inputs, which produces output. Preamplified recovered audio appears at demodulator output pin 9. C264, C265, and L251 attenuate signals above 100 kHz.

- **Audio**

Recovered audio from IC241 is routed to op amp IC411, and applied to the IC409. IC409 controls the amplification level. The control voltage is fed via the external volume on the control unit. Output of the gain control IC409 is applied to the Audio amplifier IC406. Power Amplifier IC406 amplifies the audio signal and drives the speaker.

- **Squelch**

Audio Signals at low-pass filter L251 are routed through SQUELCH RANGE RV241 that calibrates squelch-break level when the front panel SQUELCH control is maximum. Signals at RV241-top feed a two tank 60 kHz filter the resulting 60 kHz signal is amplified by IC241 and Q244, then rectified by D243 to produce a DC voltage that varies inversely with received RF-carrier level. The front panel SQUELCH control sinks current from D243 so that the voltage can be adjusted. The DC voltage is input to a level detector within IC241 and detector output is an open collector that sinks voltages to logic low when on-channel receiver input is above the squelch threshold established by RV241. Level detector output is applied through NSQ the interconnect to microcomputer input port P41 so that the microcomputer can take appropriate action.

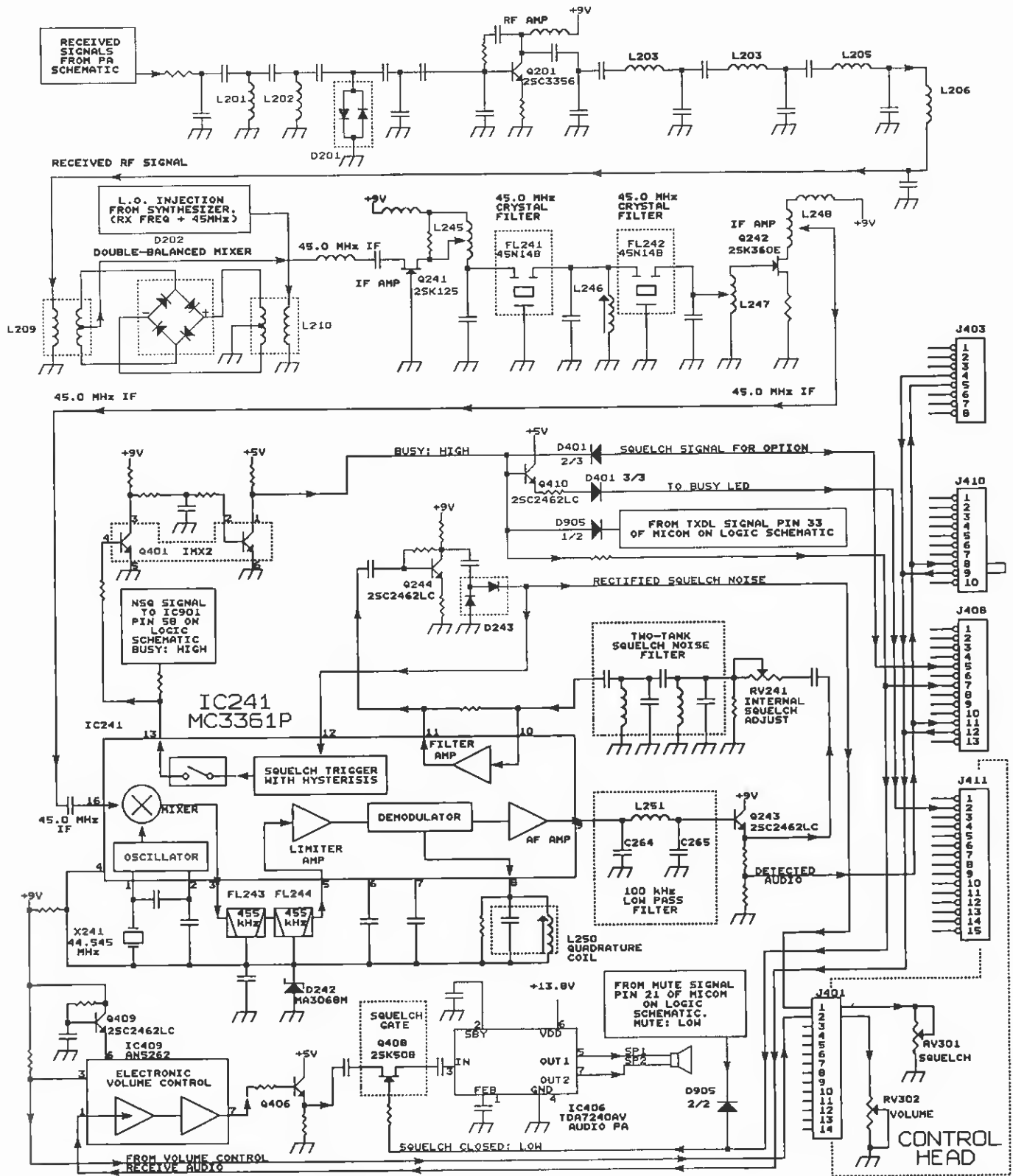


Figure 5 - 3 — Receiver Circuit (Simplified)

## CIRCUIT DESCRIPTION

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### LOGIC SECTION

#### DC POWER AND RESET

5 V DC power to all logic circuitry in the Logic portion is supplied from switched 13.6 V and is regulated by IC402. Microcomputer IC901 is powered by the 5 V drop across D903, which is sourced by IC401 9 V regulator supply.

#### MICROCOMPUTER

Radio operation is under control of a microcomputer system located on the Logic Board. This system is comprised of Microcomputer IC901 and 2K EEPROM IC903.

All CPU activity is performed step-by-step in time with a clock. The frequency of the clock is fixed by crystal X901. Because of the high clock speed, microcomputer activity seems instantaneous.

##### • Display and Switches

Rotating S305 (UP) or (DN) applies a momentary logic low to pin 56 or 55 of IC901, respectively. IC901 interprets this request as a channel change up or down and outputs the appropriate BCD display data from pin 13—pin 16 (DSP3—DSP0), which is applied to the BCD-to-Seven Segment Display driver, IC301. The channel display data is latched into IC301 by the DSP STB from pin 12 of IC901. Once latched, the appropriate channel is displayed on the channel display, D301.

Pressing S301 (MON) applies a momentary logic low to pin 50 of IC901. IC901 responds by putting CTCSS/DCS decode (if installed) in the monitor state and outputs a logic high from pin 13 (DSP3) which is latched in IC302 by the LED STB sent from pin 11. The logic high is inverted by Q302-2/2 to light the MON LED, D303.

Pressing optional switch S302 (PSCAN) applies a momentary logic low to pin 51 of IC901. IC901 places the radio in the PSCAN mode and indicates this by outputting a logic high from pin 16 (DSP0) which is latched into IC302 by the LED STB sent from pin 11. The logic high is inverted by Q302-1/2 to light the optional PSCAN LED, D304.

Before going into the PSCAN mode, pressing S304 (ADD/DEL) applies a momentary logic low to pin 49 of IC901. IC901 outputs to the ADD/DEL LED

(D306), causing it to begin flashing, allowing the user to check the PSCAN list.

During transmit, TX 9V is present at the anode of D701, which applies a positive voltage to the anode of the TX LED, turning it on. When a signal is received, Q410 is turned on, which allows a positive voltage to be applied to the anode of the BUSY LED via D401-3/3.

##### • CTCSS/DCS Encode/Decode

IC901 controls CTCSS/DCS encode and decode. If the optional 70-2157 CTCSS board has been installed, during receive mode the receive audio signal is high-pass filtered at IC50 (on the 70-2157 board) to remove the CTCSS/DCS tones/codes. The CTCSS/DCS square wave is input through the Signal I/O line, pin 8 of IC901. IC901 determines if the CTCSS/DCS signal received is a valid tone/code. If it is valid, the output at pin 21 (MUTE) will go to logic high, which opens radio squelch.

In TX mode, pin 8 of IC901 will output the programmed CTCSS/DCS tone/code to the 70-2157 board, if installed. TXDL goes low, turning off Q1, which turns on IC2-2/4 and IC2-4/4, allowing the tone/code on the Signal I/O line to pass through IC1. IC1 is a programmable filter that "cleans up" CTCSS/DCS tones/codes. The generated tone is applied to Level Adjust RV1, and from there to Balance Control RV401 via C6. The signal is then sent to IC411-3/4, where it is mixed with the mic audio, and also to D102 in the reference oscillator.

##### • RX and TX Switching

In receive mode, TXDL (pin 33 of IC901) is at logic high. This turns Q705 on, which causes Q702-1/2 to turn on. This applies RX8V to the VCO. Also, when TXDL is high, Q703-1/2 turns on, and Q703-2/2 turns off. This turns Q702-2/2 and Q704 off, which turns TX8V and TX9V off.

In transmit mode, TXDL is at logic low. This turns Q703-1/2 off, which turns Q703-2/2 on. This turns Q702-2/2 and Q704 on, which turn TX8V and TX9V on. Also, when TXDL is low, this turns Q705 off, which causes Q702-1/2 to turn off. This turns RX8V off, and TX8V and TX9V on.

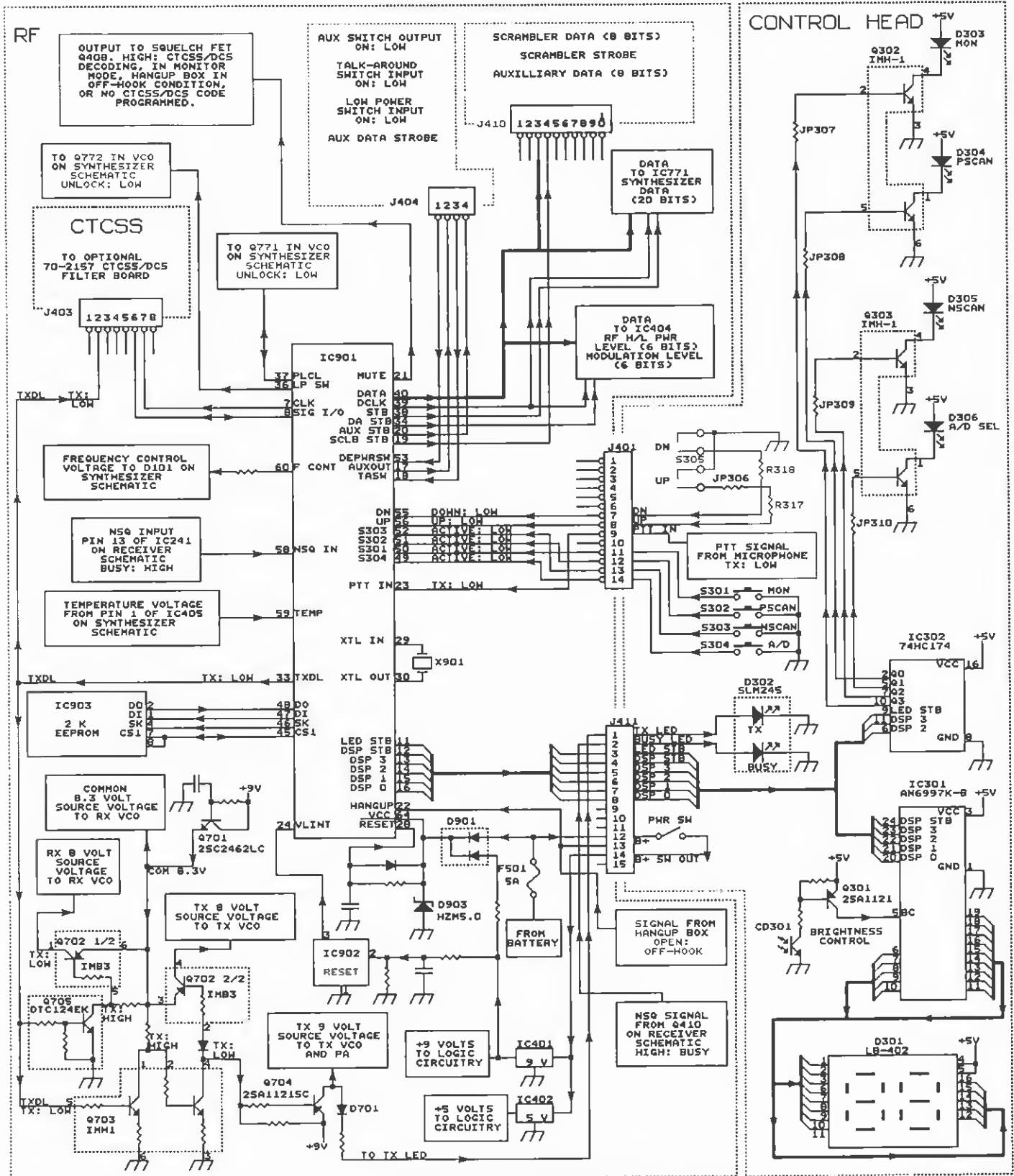


Figure 5 - 4 — Logic Circuit (Simplified)

## CIRCUIT DESCRIPTION

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- **Data Control**

When the radio is turned on, the contents of EEPROM IC903 are serially clocked into IC901 so that it can set up receiver frequency, scan operation, transmit/receive hold timer, busy-channel lock-out timer, time-out-timer and reference oscillator frequency control.

When a channel is changed, or when PTT is pressed, the contents of EEPROM IC903 are sent to IC901. IC901 then uses this data to send the appropriate information for the channel selected to IC771, CTCSS/DCS circuitry, display circuitry, and any signalling options.

- **Reference Oscillator Frequency Control**

The resistance of thermistor R107 varies with temperature. This resistance change is converted to a voltage by IC405. Output of IC405 is sent to IC901

pin 59 (TEMP). IC901 compares this data internally with the preset crystal type and programmed offset, and outputs a compensating voltage from pin 60 (F CONT). This voltage is sent to varactor diode D101 to stabilize the frequency of the reference oscillator.

- **Transmit Output Power Control**

Power level data is sent from IC901 pin 40 (DATA) to IC404 (the D/A converter) and outputs a reference voltage from pin 4 as described under "Automatic Power Control" on page 5 - 5.

- **Modulation Level Control**

Modulation level data is sent from IC901 pin 40 (DATA) to IC404 (the D/A converter) and outputs a reference voltage from pin 2, which adjust the gain of IC408. This controls the modulation level as described under "Modulator", page 5 - 3.



Table 5-1—IC901 PINOUTS

Pin No.	Pin Name	I/O Flow	Function Label	Logic & Function
1	P37	I	PC RTS	Programmer Interface
2	P36	O	PC CTS	Programmer Interface
3	P35	O	PC RD	Programmer Interface
4	P34	I	PC SD	Programmer Interface
5	P33	I	PC CD	Programmer Interface
6	P32	O	BEEP	Beep Tone Output
7	P31	O	CLK	Clock Output for CTCSS/CDCSS
8	P30	I/O	SIGNAL IO	Signal I/O for CTCSS/CDCSS
9	P57	O	LEDCHK	LED Check Output
10	P56	O	LEDAUX	not used
11	P55	O	LED STB	Parallel-Data Strobe for Indicators
12	P54	O	DSP STB	Parallel-Data Strobe for Displays
13	P53	O	DSP3	Display/LED Data
14	P52	O	DSP2	Display/LED Data
15	P51	O	DSP1	Display/LED Data
16	P50	O	DSP0	Display/LED Data
17	P67	O	AUXOUT	Aux Switch Output (Low = ON)
18	P66	I	TASW	Talk-around Switch Input (Low = ON)
19	P65	O	SCRB STB	Serial Data Strobe for Voice Scrambler
20	P64	O	AUX STB	Serial Data Strobe for AUX
21	P63	O	MUTE	Low = MUTE
22	P62	I	HANGUP	Low = HANG UP
23	P61	I	PTT	Low = TX
24	P60	I	VLINT	Low = LOW VOLTAGE
25	R/W	O	—	not used
26	SYNC.	O	—	not used
27	CNV <sub>SS</sub>	I	—	GND
28	RESET	I	—	Low = MICROCOMPUTER RESET
29	X <sub>IN</sub>	I	—	Crystal Oscillator, 8 MHz
30	X <sub>OUT</sub>	O	—	Crystal Oscillator, 8 MHz
31	0	O	—	not used
32	V <sub>SS</sub>	I	—	GND
33	P27	O	TXDL	Low = TX ACTIVATE
34	P26	O	DA STB	Serial Data Strobe for D/A Converter
35	P25	O	VCOSW	VCO Switch Signal Output
36	P24	O	LPSW	Loop Switch Signal Output
37	P23	I/O	PLCL	Synth Unlock (Low = UNLOCK)
38	P22	O	DSTB	Serial Data Strobe for Synthesizer
39	P21	O	DCLK	Clock for Serial Data
40	P20	O	CHDT	Serial Data Output
41	P17	I/O	—	not used
42	P16	I/O	ECS4	Chip Select for EEPROM 4
43	P15	I/O	ECS3	Chip Select for EEPROM 3
44	P14	I/O	ECS2	Chip Select for EEPROM 2
45	P13	I/O	ESC1	Chip Select for EEPROM 1
46	P12	O	ECLK	Clock for EEPROM
47	P11	O	EDI	Data Input Into EEPROM
48	P10	I	EDO	Data Output from EEPROM
49	P07	I	AUXSW/CH0	AUX Switch (Low = ACTIVE)/CHNL NO. INPUT
50	P06	I	MONSW/CH1	Monitor Switch (Low = ACTIVE)/CHNL NO. INPUT
51	P05	I	PRI SW/CH2	PRI Switch (Low = ACTIVE)/CHNL NO. INPUT
52	P04	I	SCAN SW/CH3	SCAN Switch (Low = ACTIVE)/CHNL NO. INPUT
53	P03	I	DEP WRSW/CH4	DE-POWER Switch (Low = ACTIVE)/CHNL NO. INPUT
54	P02	I	—/CH5	not used/CHNL NO. INPUT
55	P01	I	DNSW/CH6	DOWN Switch (Low = ACTIVE)/CHNL NO. INPUT
56	P00	I	UPSW/CH7	UP Switch (Low = ACTIVE)/CHNL NO. INPUT
57	P42	I	VTIN	not used
58	P41	I	NSQIN	NSQ Status Input (High = RECEIVE)
59	P40	I	TMPRTR	Thermal Sensor Input
60	DA2	O	REFCNT	Reference Frequency Control Output
61	DA1	O	—	not used
62	VREF	I	—	Reference Voltage Input to Convert A/D
63	AVSS	I	—	GND
64	VCC	I	—	+5 V

**CIRCUIT DESCRIPTION**

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70-1340/1440

**NOTES**

**SECTION 6**

**DIAGRAMS**

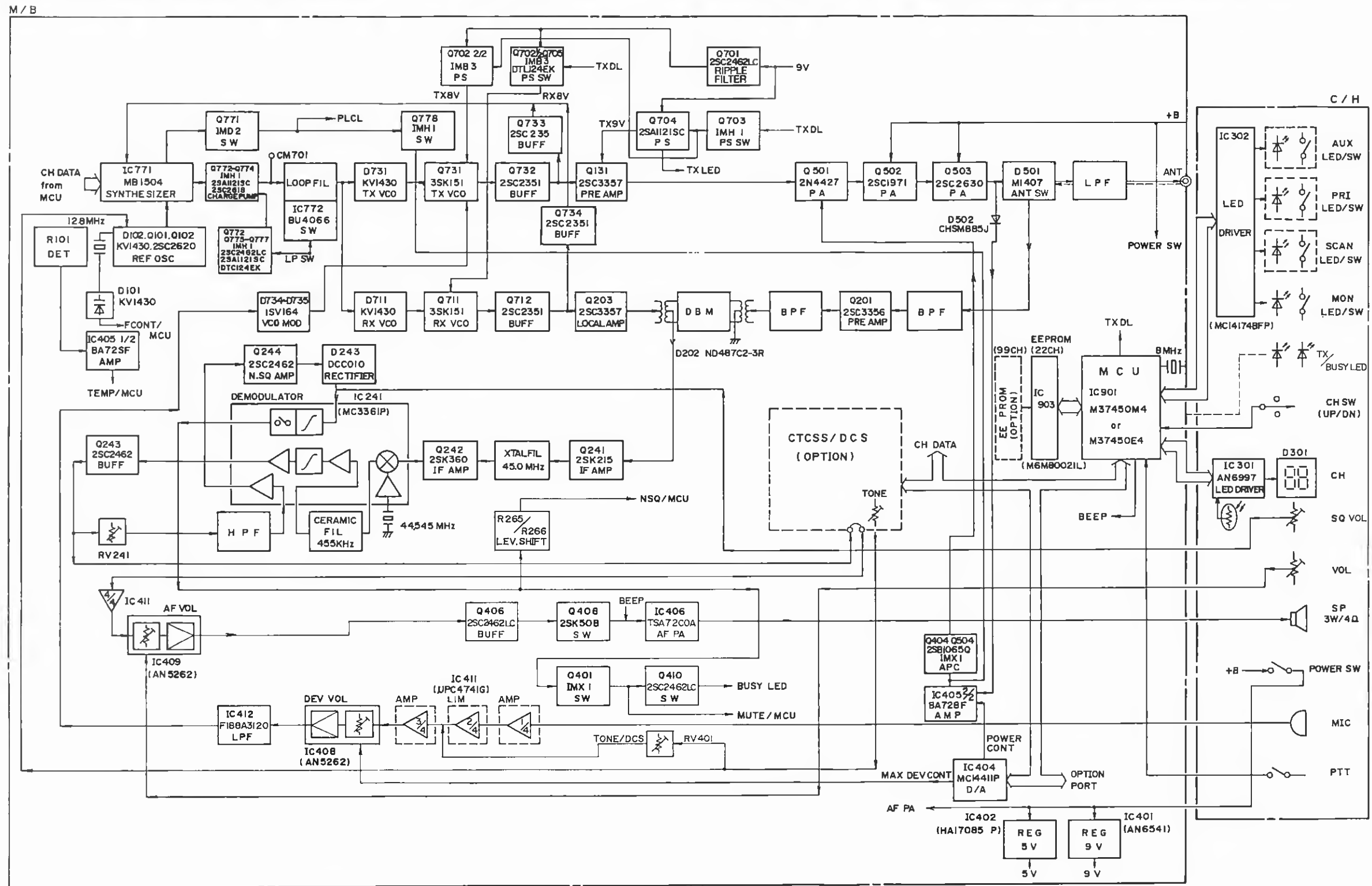
## DIAGRAMS

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70-1340/1440

## NOTES

A B C D E F G H I J K L M



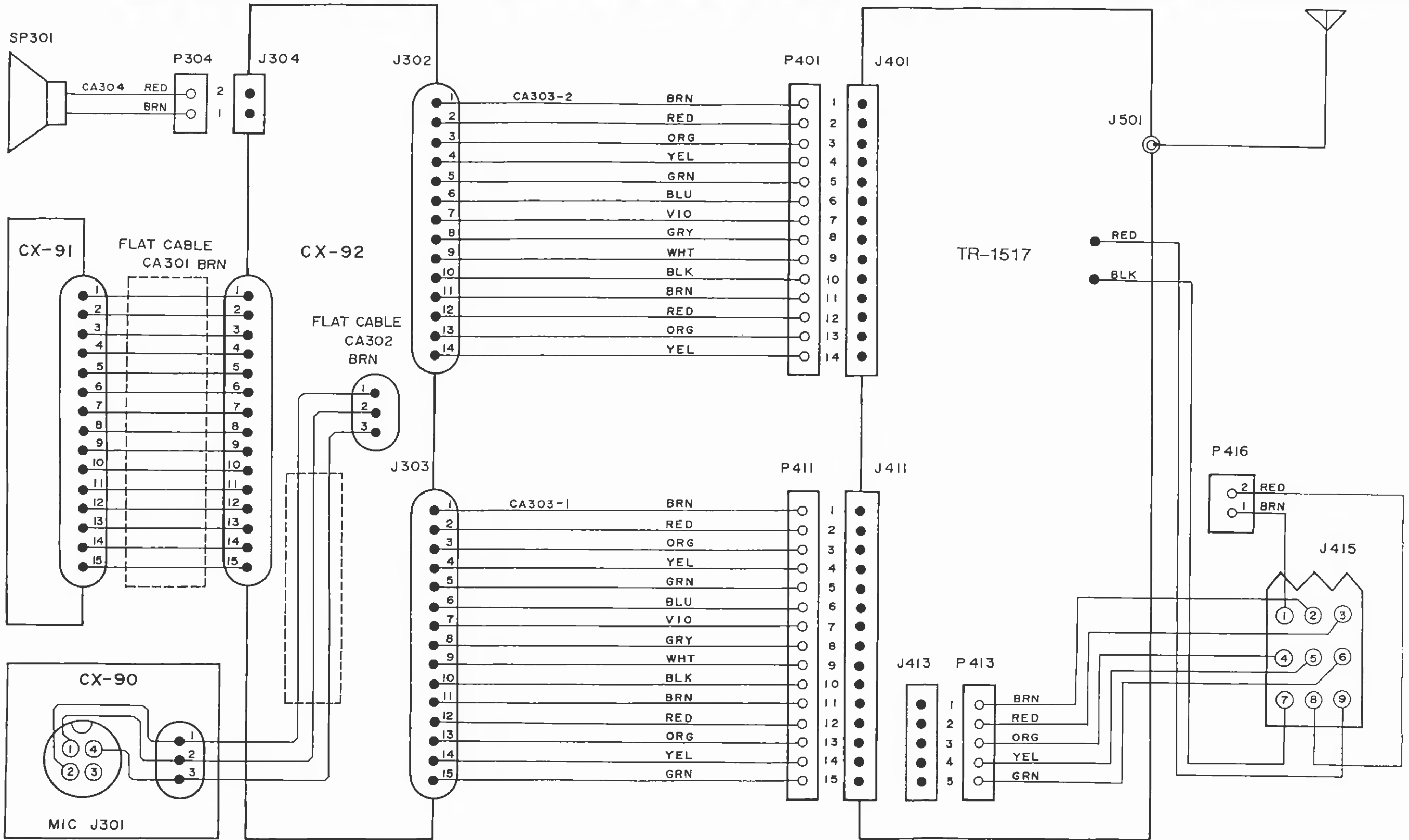
OPTION

UNDER-DASH WIRING DIAGRAM

70-1340/1440

A	B	C	D	E	F	G	H	I	J	K	L	M
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- 7
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## 70-1340/1440



CONTROL HEAD LAYOUTS

70-1340/1440

A

B

C

D

E

F

G

H

I

J

K

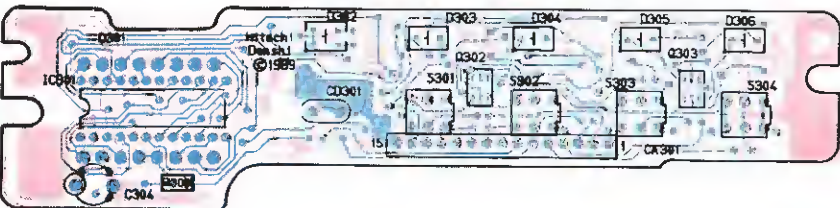
L

M

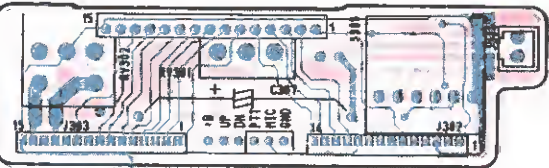
CX-90 LAYOUT  
TOP VIEW



CX-91 LAYOUT  
TOP VIEW



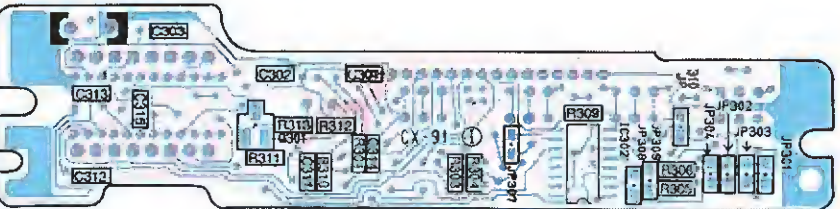
CX-92 LAYOUT  
TOP VIEW



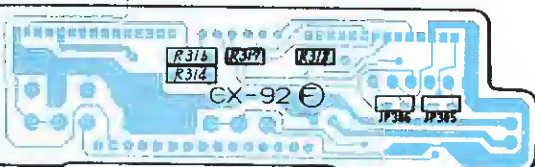
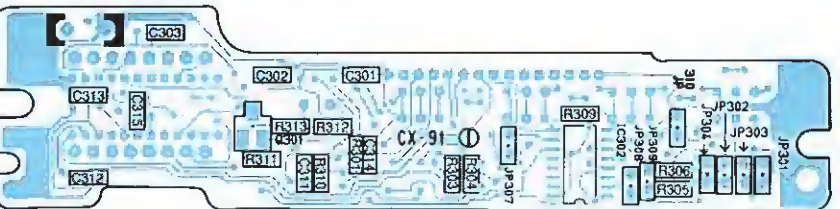
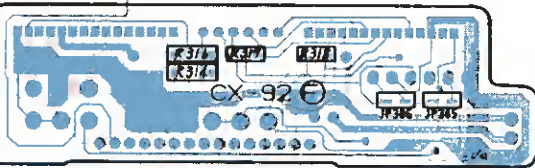
BOTTOM VIEW



BOTTOM VIEW



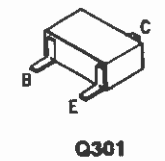
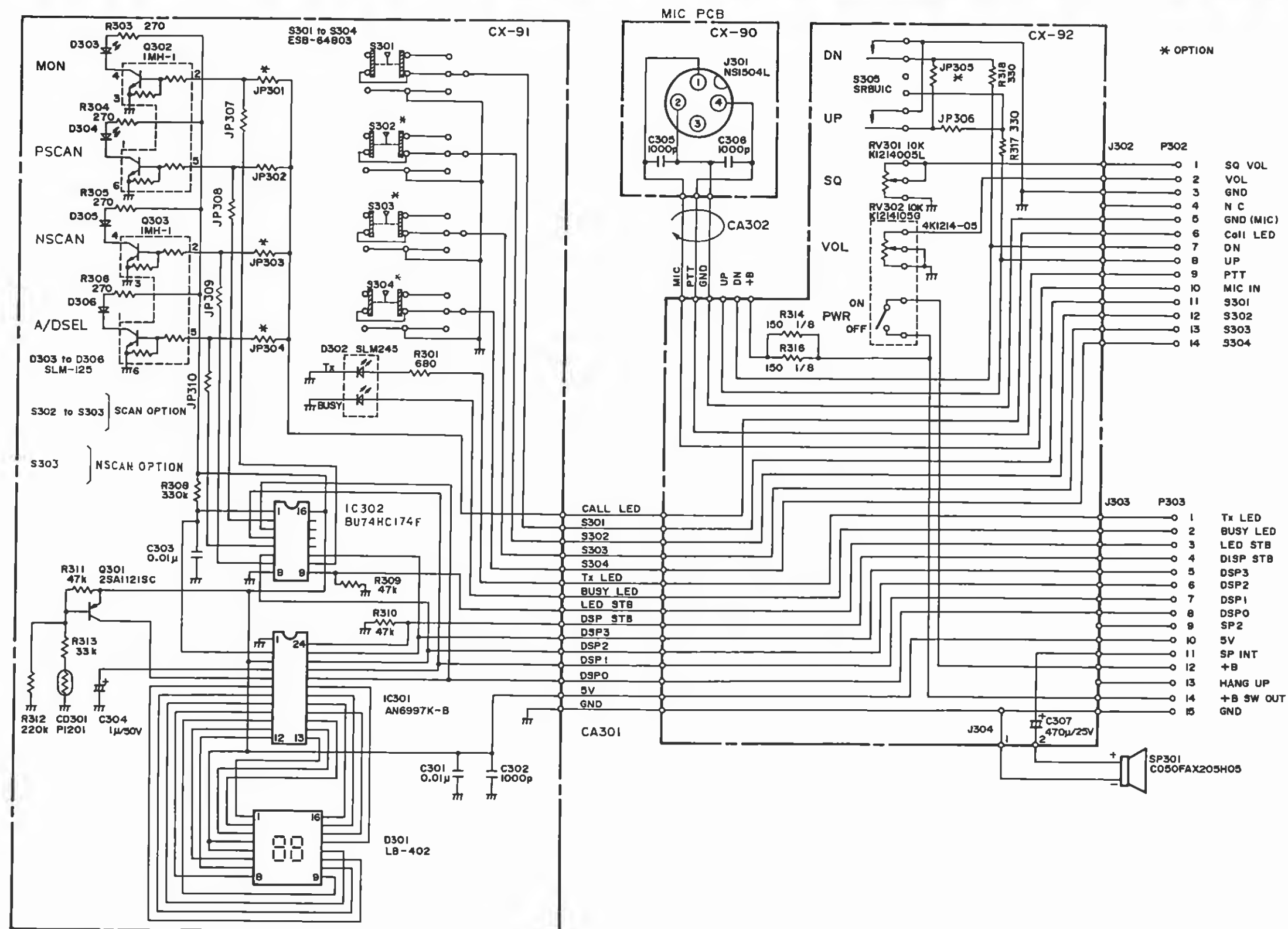
BOTTOM VIEW



BLUE VISIBLE PLATING  
RED UNDERSIDE PLATING



A B C D E F G H I J K L M



TRUNK-MOUNT SCHEMATIC

70-1340/1440

A B C D E F G H I J K L M

1

2

3

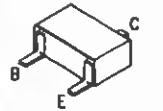
4

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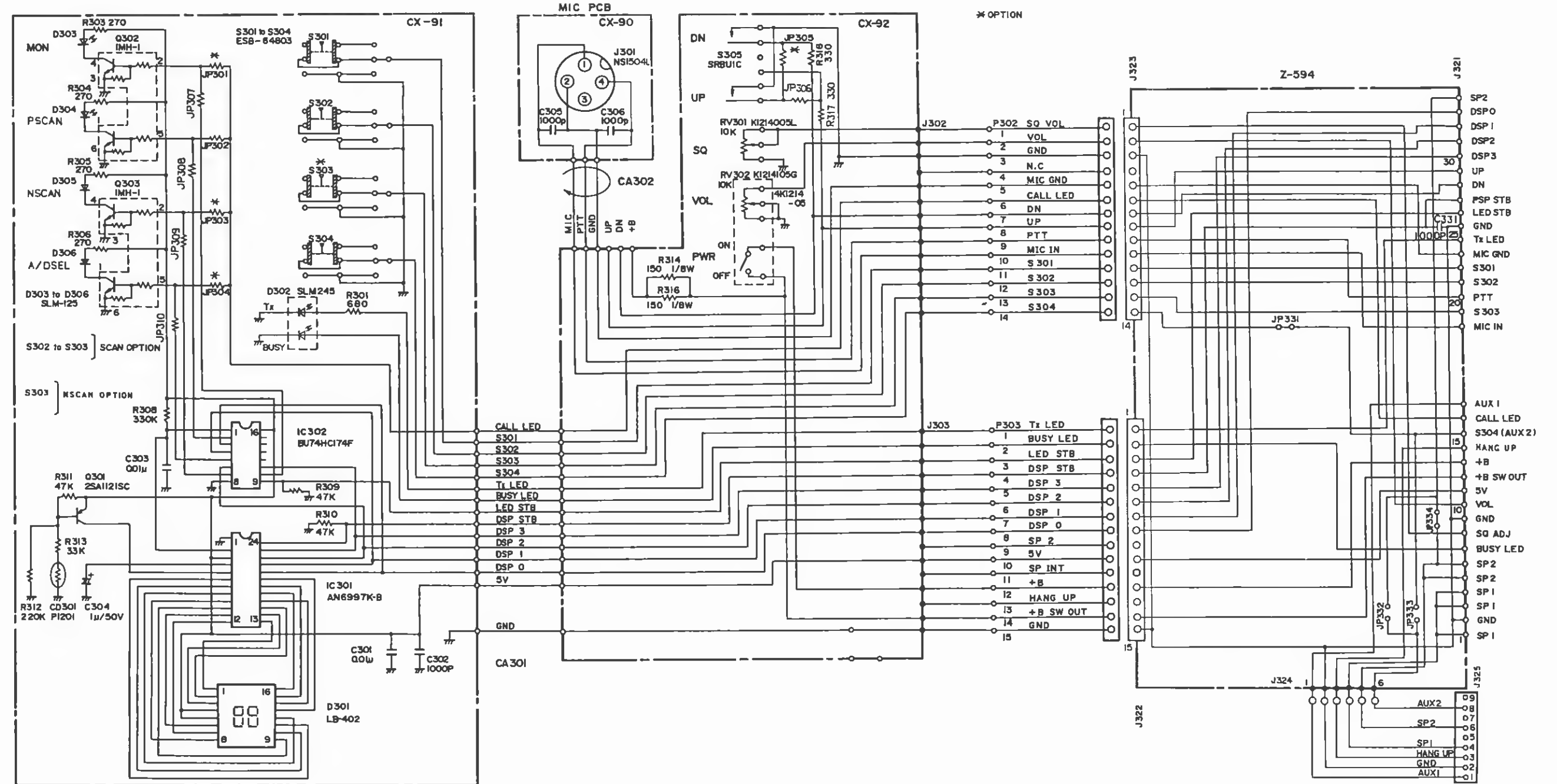
8



Q301



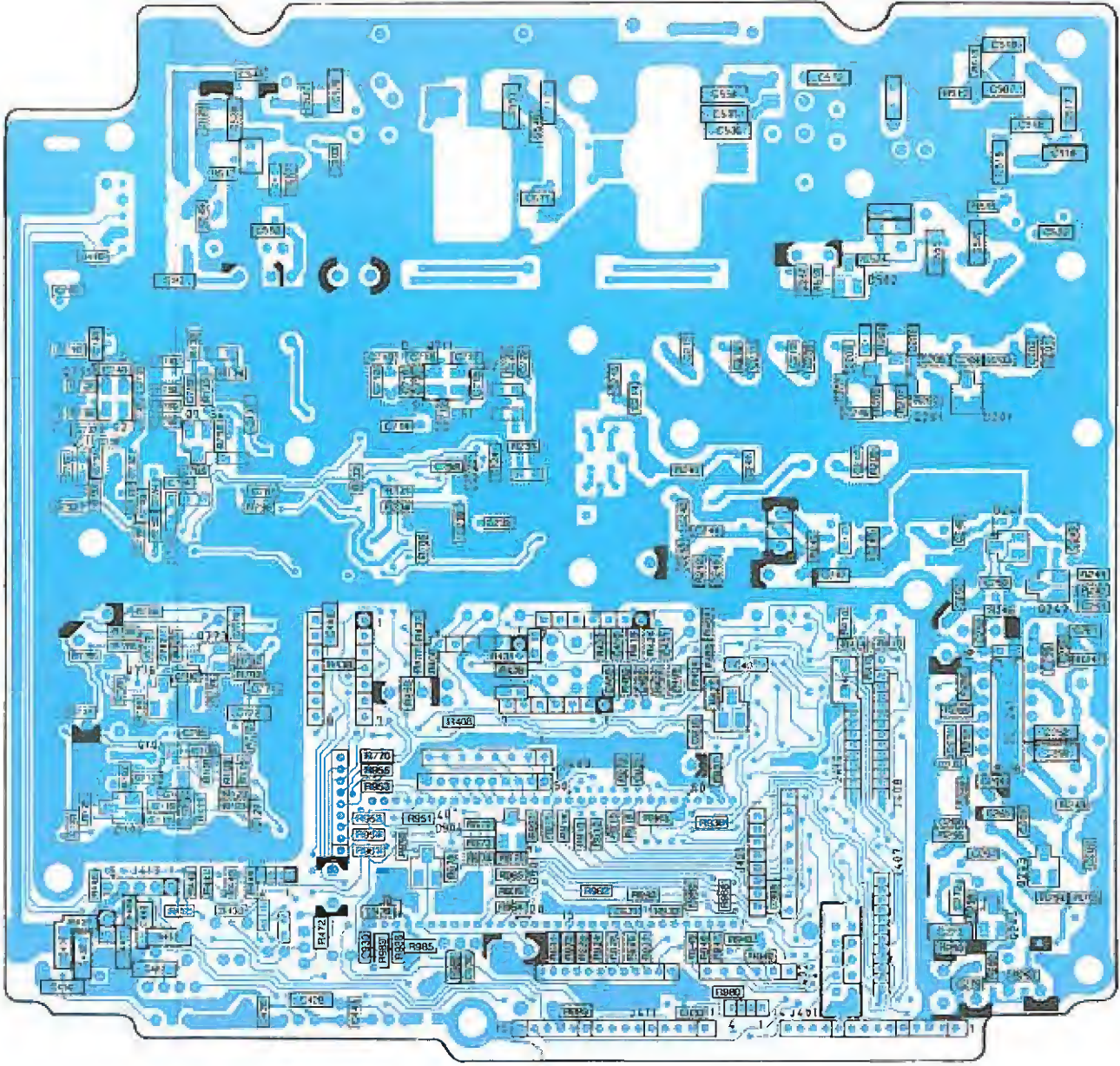
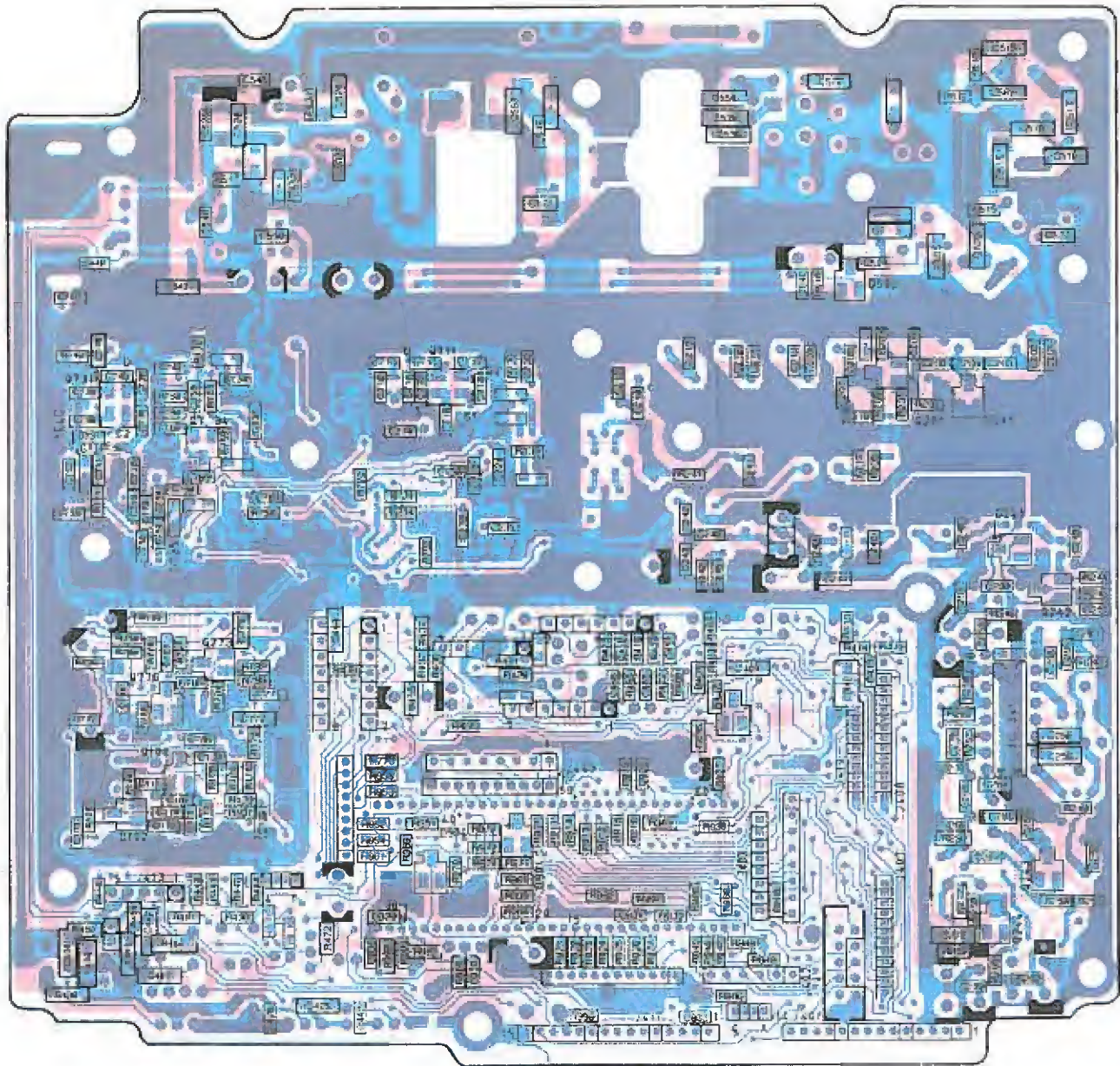
Q302, Q303





A	B	C	D	E	F	G	H	I	J	K	L	M
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BLUE VISIBLE PLATING

RED UNDERSIDE PLATING



# TR-1517 LAYOUT—TOP VIEW

70-1340/1440

A

B

C

D

E

F

G

H

I

J

K

L

M

1

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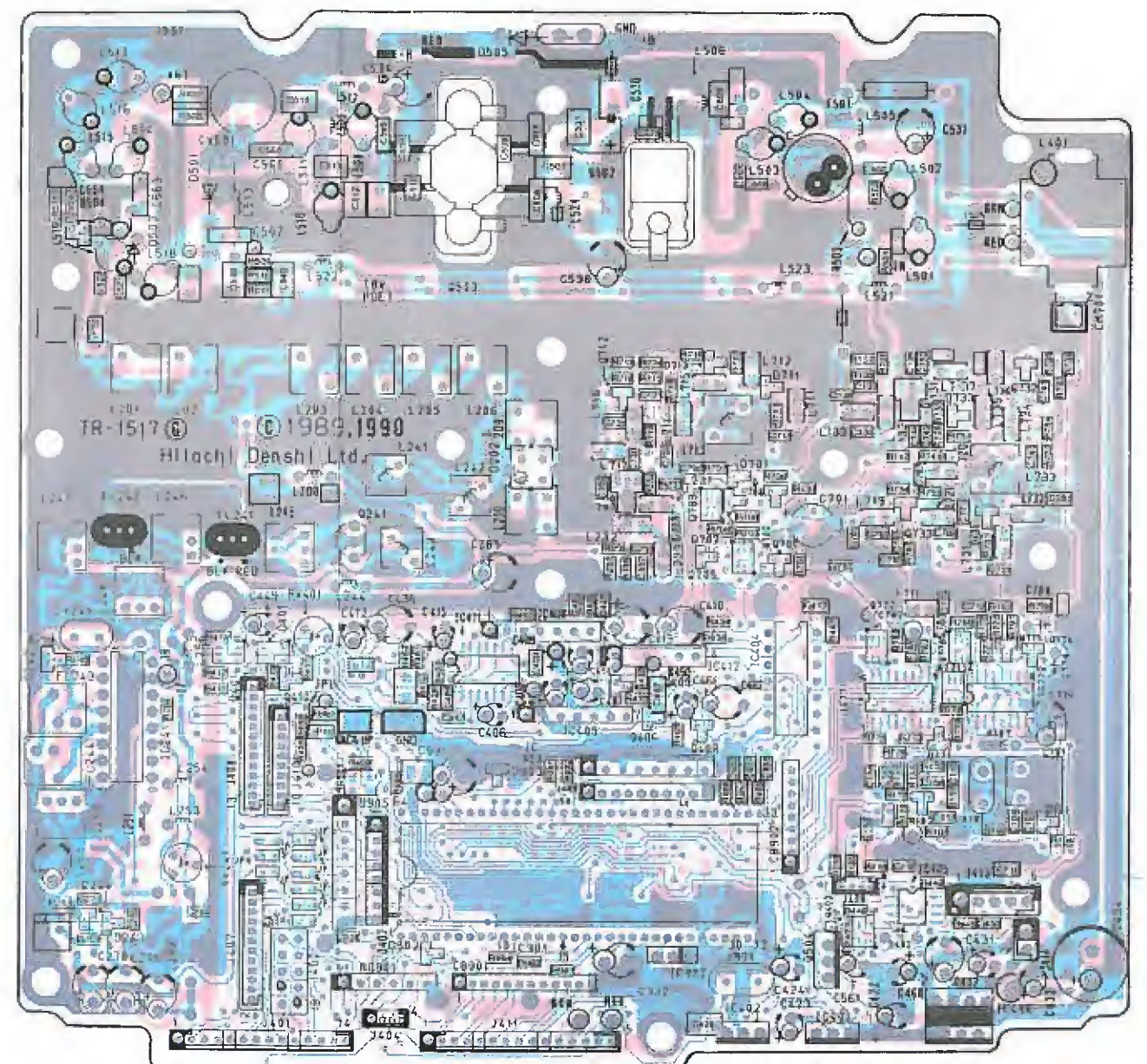
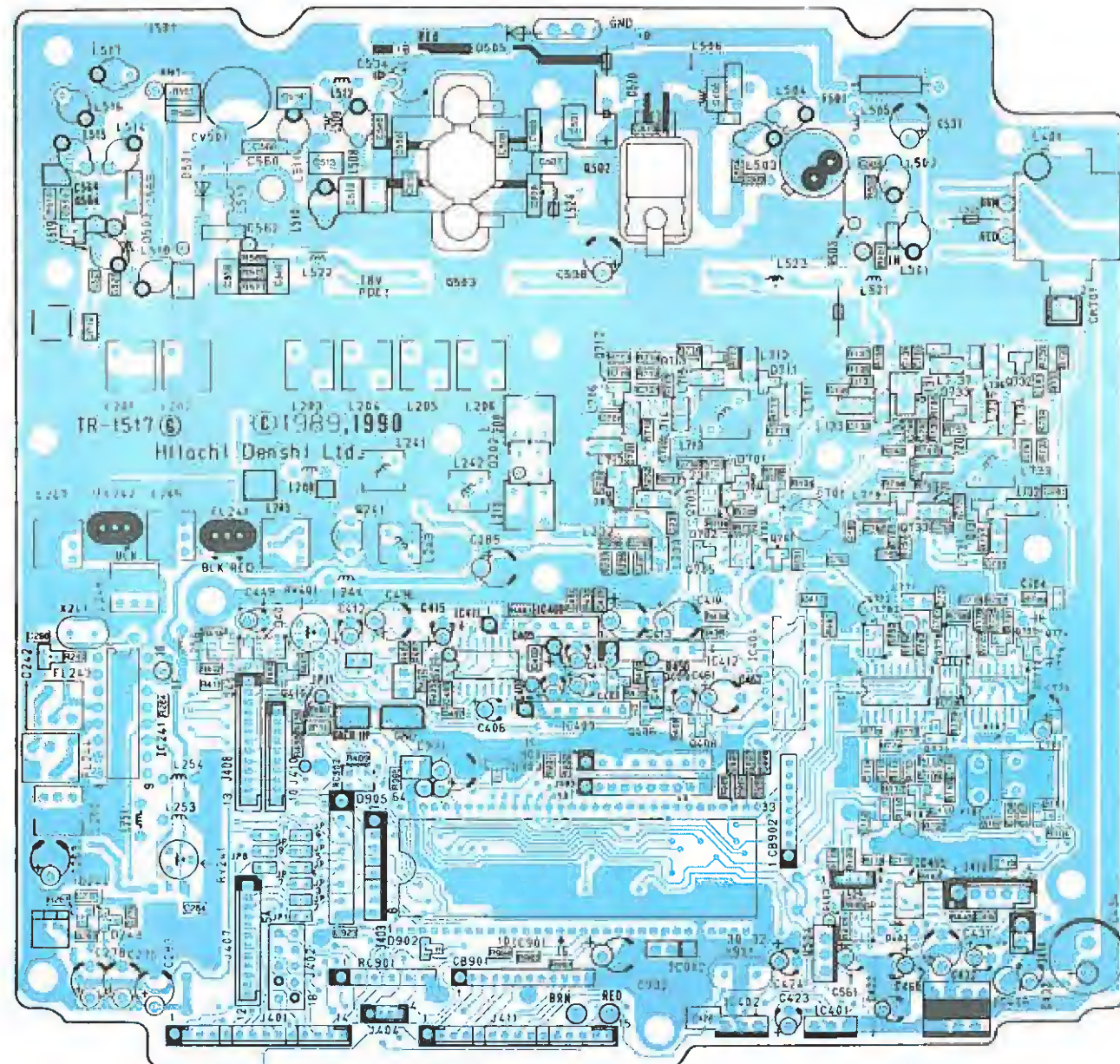
4

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BLUE VISIBLE PLATING

RED UNDERSIDE PLATING





TR-1517 TRANSISTOR PINOUTS

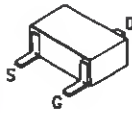
TR-1517 DIODE PINOUTS

70-2157 CTCSS FILTER BOARD LAYOUT

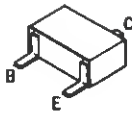
70-1340/1440

A B C D E F G H I J K L M

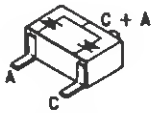
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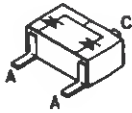
Q242



Q101, Q102, Q201, Q243, Q244, Q406, Q409, Q410, Q701, Q704, Q705, Q712, Q732, Q733, Q734, Q773, Q774, Q775, Q776



D201, D243, D502

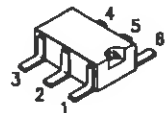


D101, D102, D711, D713, D731, D733, D771, D901, D904

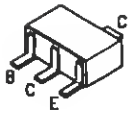
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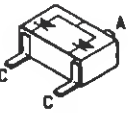
Q408



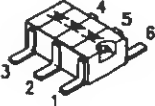
Q401, Q403, Q702, Q703, Q771, Q772, Q778



Q131, Q203

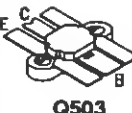


D241, D244, D701, D702, D802, D907



D401

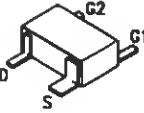
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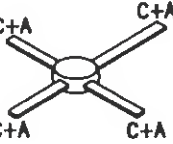
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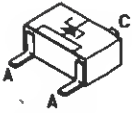
Q241



Q711, Q731

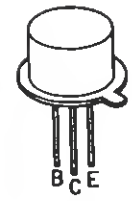


D202



D903, D906

6



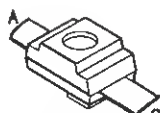
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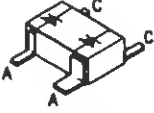
Q504



Q502



D734, D735

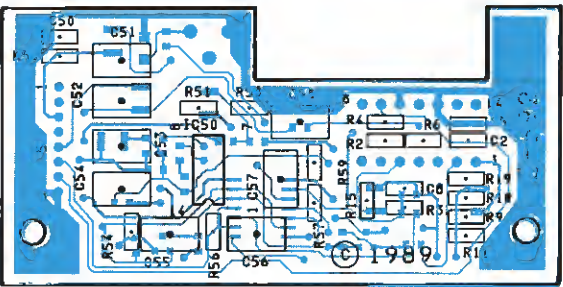
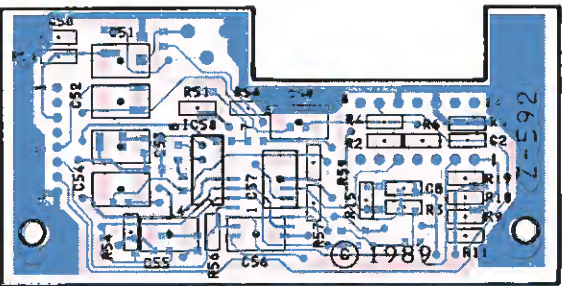


D905

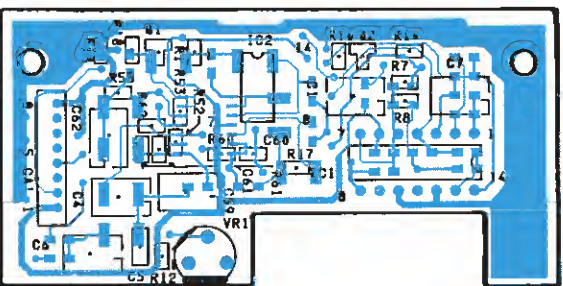
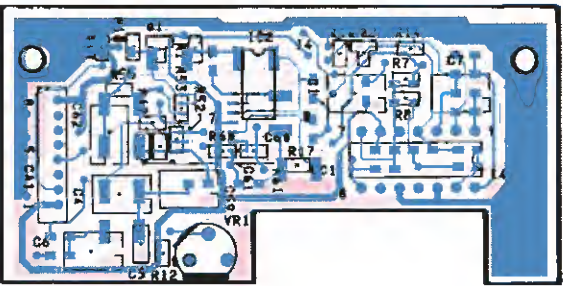
7

8

TOP VIEW

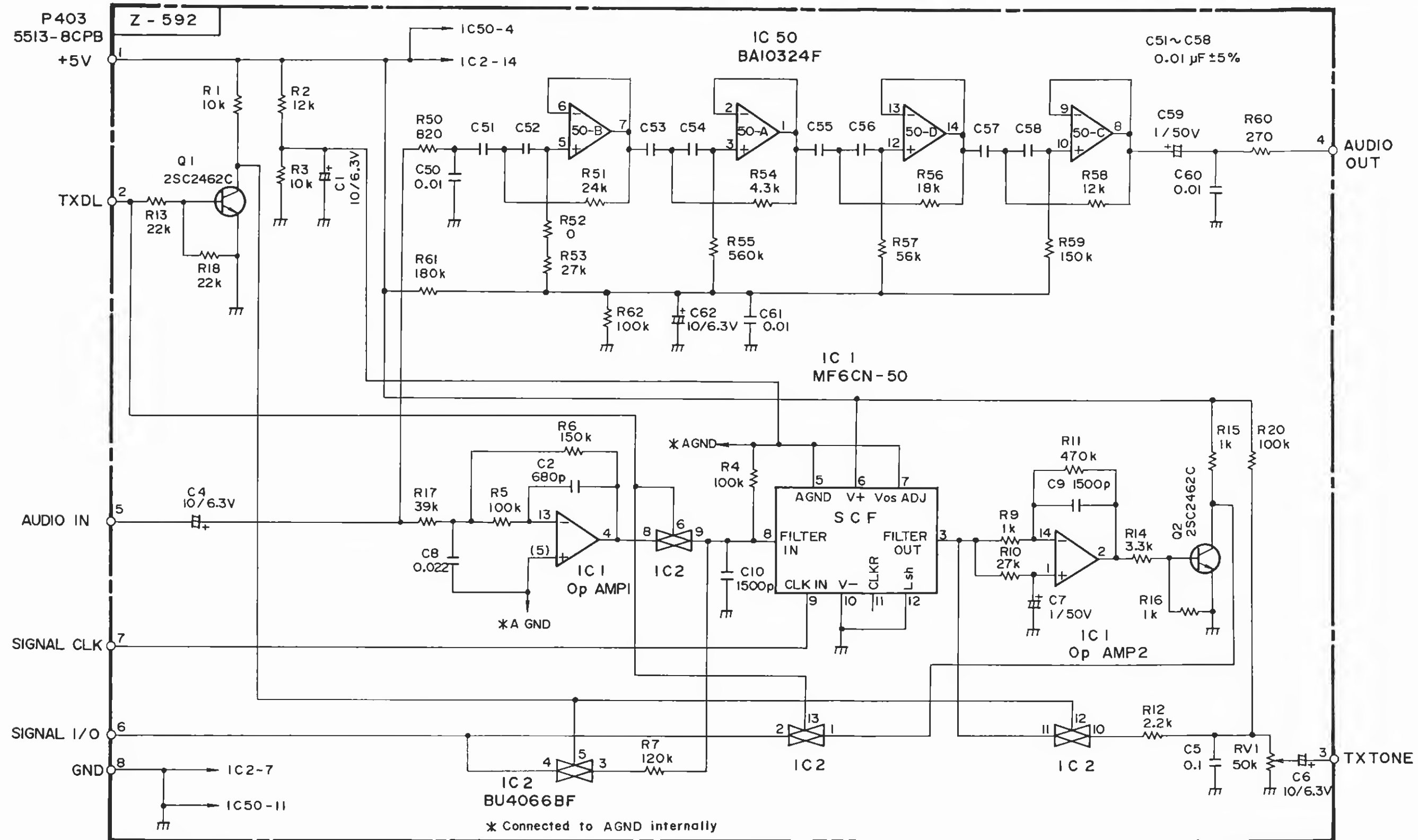


BOTTOM VIEW



RED UNDERSIDE PLATING

BLUE VISIBLE PLATING

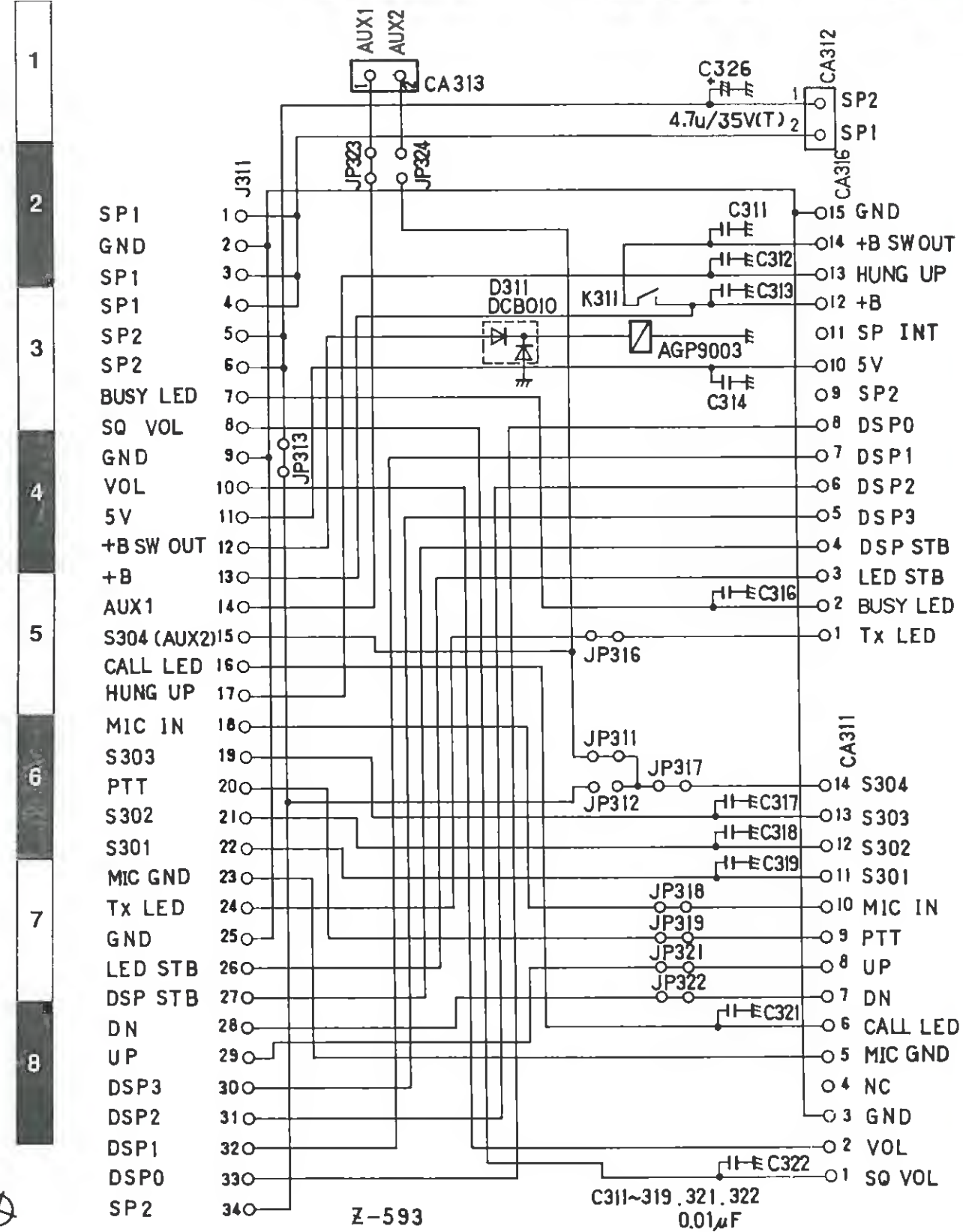




Z-593 SCHEMATIC

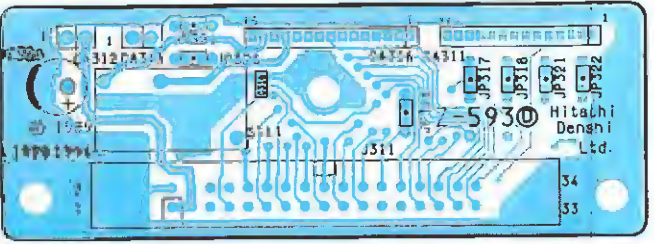
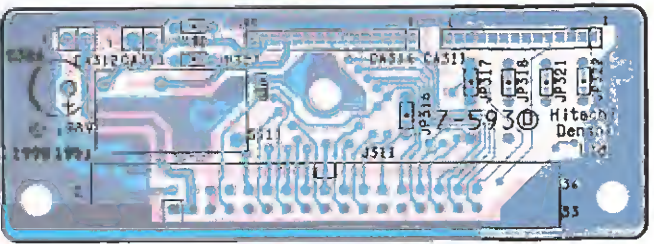
70-1340/1440

A	B	C	D	E	F	G	H	I	J	K	L	M
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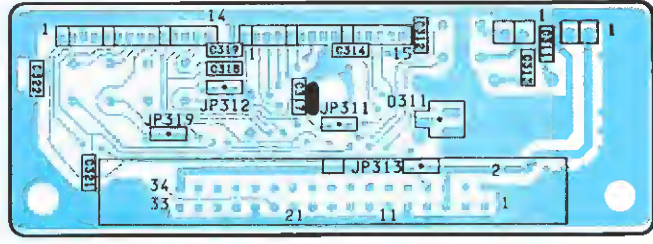
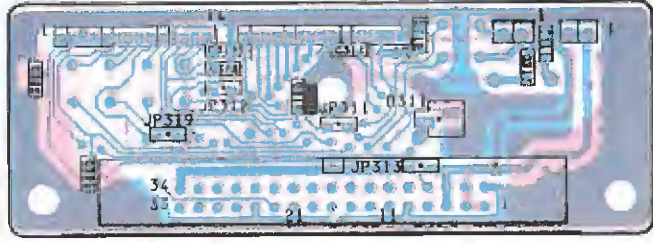


Z-593 LAYOUT

TOP VIEW

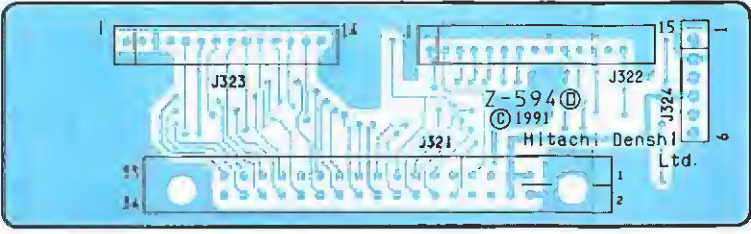
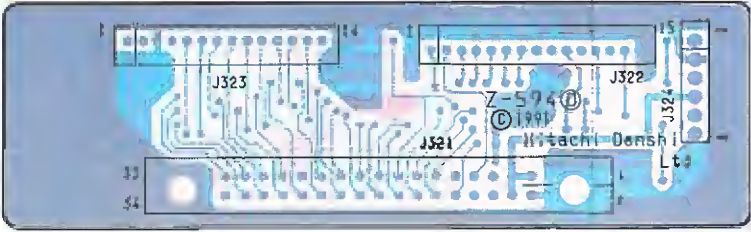


BOTTOM VIEW

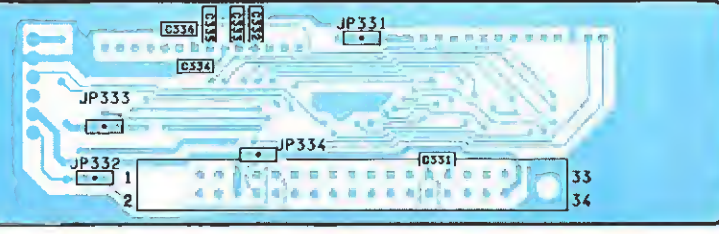
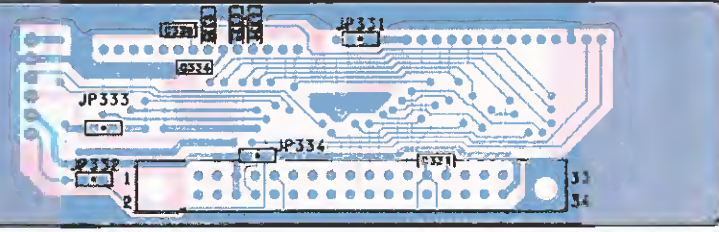


Z-594 LAYOUT

TOP VIEW



BOTTOM VIEW



BLUE VISIBLE PLATING  
RED UNDERSIDE PLATING



# UNDER-DASH EXPLODED VIEW

70-1340/1440

A B C D E F G H I J K L M

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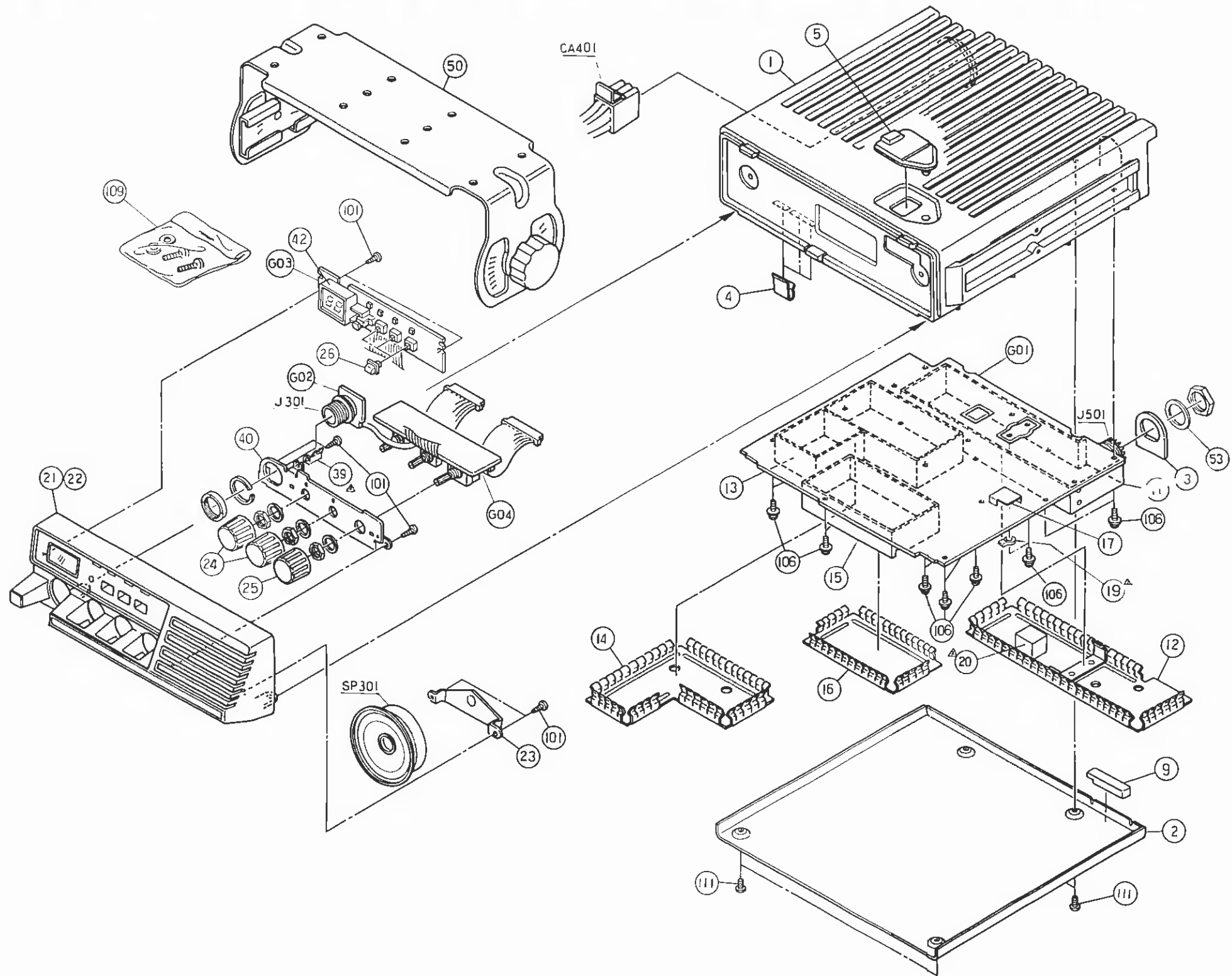
4

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REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-010261
2	COVER	70-010262
3	ANT PANEL	70-010263
4	CLIP	70-150126
5	ROM PACKING	70-157356
9	DUST PACKING	70-157372
11	PA SHIELD CASE	70-089339
12	PA SHIELD COVER	70-089340
13	VCO SHIELD CASE	70-089341
14	VCO SHIELD COVER	70-089342
15	LOG SHIELD CASE	70-089343
16	LOG SHIELD COVER	70-089344
17	IF SHIELD COVER	70-089346
19	GROUND LUG	70-151271
20	SPACER	70-150148
21	FRONT COVER	70-010264
23	SP BRACKET	70-158324
24	VOLUME KNOB	70-110066
25	VOLUME KNOB	70-110067
28	SWITCH BUTTON	70-110068
38	PCB GUIDE	70-150140
40	VOLUME BRACKET	70-158326
42	LED SPACER	70-150133
50	BRACKET ASSY	70-158327
53	WASHER	70-150477
101	SCREW PLAX PAN HD M3x10	70-150136
106	SCREW PAN HD M3x8	70-150126
109	FIXED SCREW	70-000012
111	SCREW BIND HD M3 x 8	70-150436

TRUNK-MOUNT EXPLODED VIEW

70-1340/1440

A

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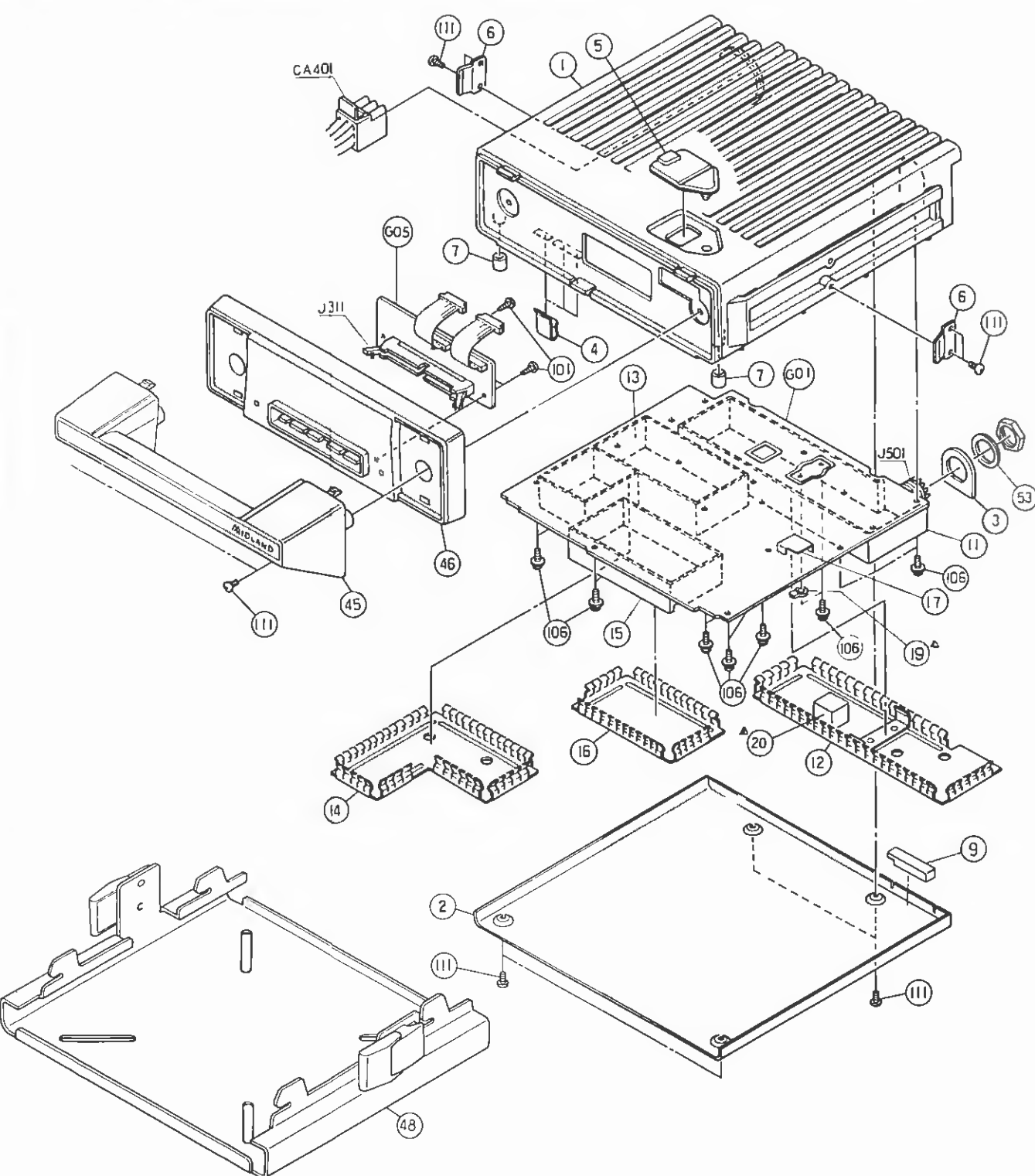
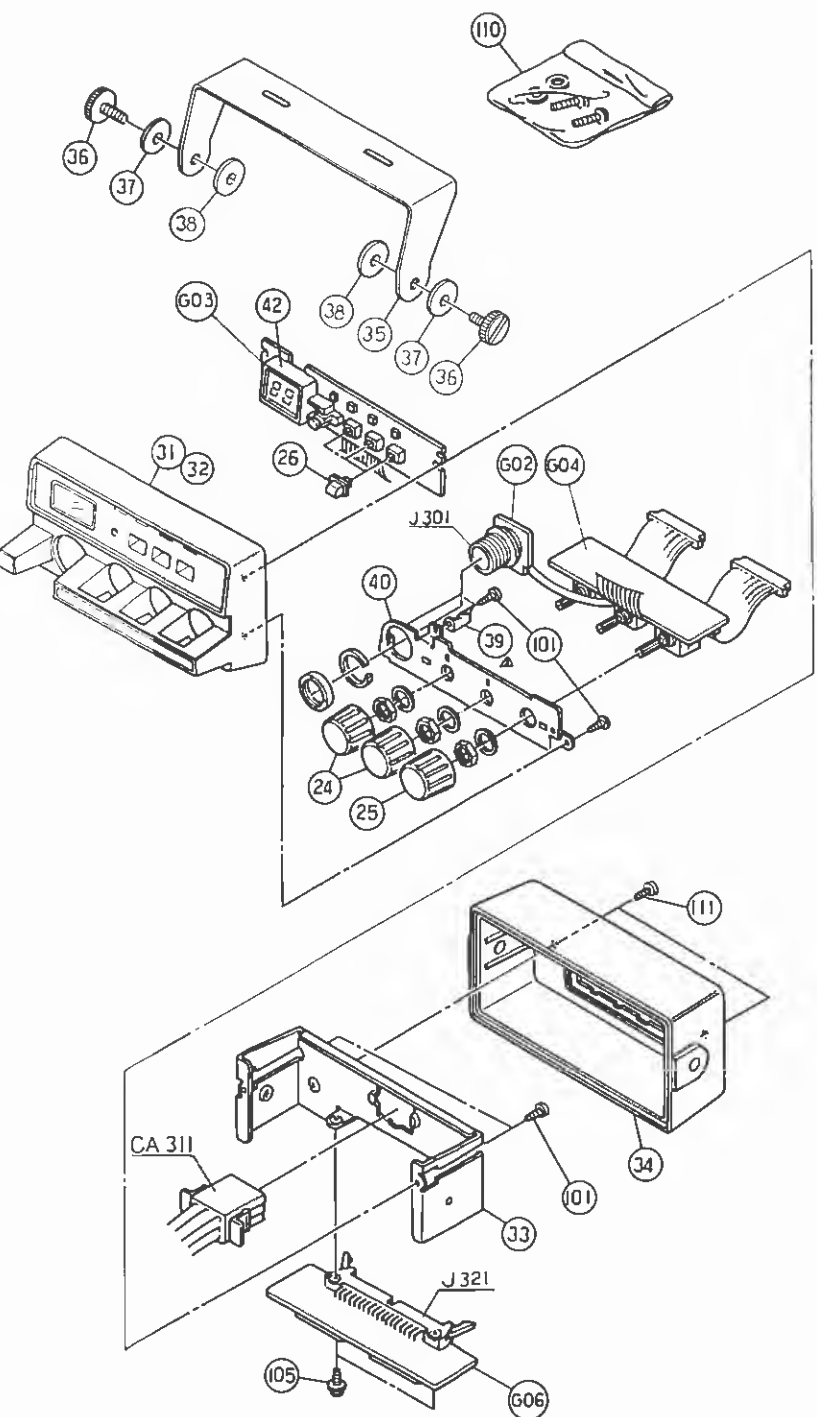
5

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8

REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-010261
2	COVER	70-010262
3	ANT PANEL	70-010263
4	CLIP	70-150126
5	ROM PACKING	70-157358
6	BRACKET	70-158323
7	CAP	70-150127
8	DUST PACKING	70-157372
11	PA SHIELD CASE	70-089339
12	PA SHIELD COVER	70-089340
13	VCO SHIELD CASE	70-089341
14	VCO SHIELD COVER	70-089342
15	LOG SHIELD CASE	70-089343
16	LOG SHIELD COVER	70-089344
17	IF SHIELD COVER	70-089349
19	GROUND LUG	70-151271
20	SPACER	70-150148
24	VOLUME KNOB	70-110068
25	VOLUME KNOB	70-110067
28	SWITCH BUTTON	70-110068
31	CONT CASE ASSY	70-010268
33	CONT CHASSIS	70-010267
34	CONT COVER	70-010268
35	CONT BRACKET	70-148328
36	COIN SCREW	70-150130
37	FIBER WASHER	70-151367
38	RUBBER WASHER	70-151364
39	PCB GUIDE	70-150140
40	VOLUME BRACKET	70-158328
42	LED SPACER	70-150133
45	HANDLE	70-158325
46	HANDLE BASE	70-150132
48	BRACKET ASSY	70-158326
53	WASHER	70-150477
101	SCREW PLAX PAN HD M3x10	70-150138
105	SCREW SEMS PAN HD M2x14	70-150131
106	SCREW PAN HD M3x8	70-150128
110	FIXED SCREW	70-000013
111	SCREW BIND HD M3 x 8	70-150436



A	B	C	D	E	F	G	H	I	J	K	L	M
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1

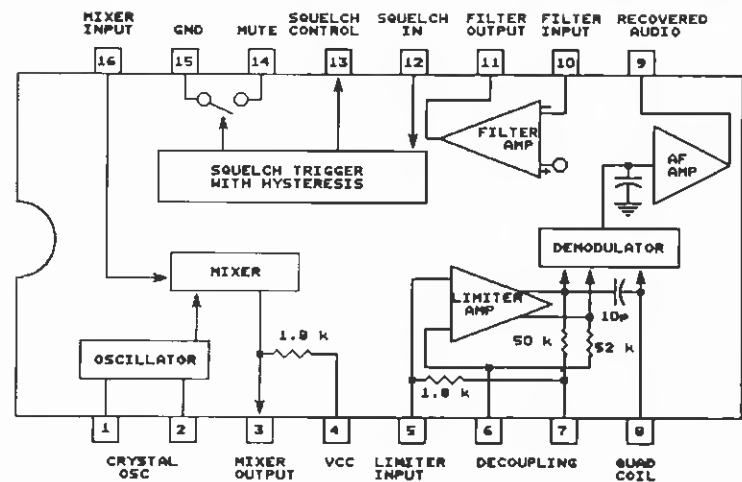
2

3

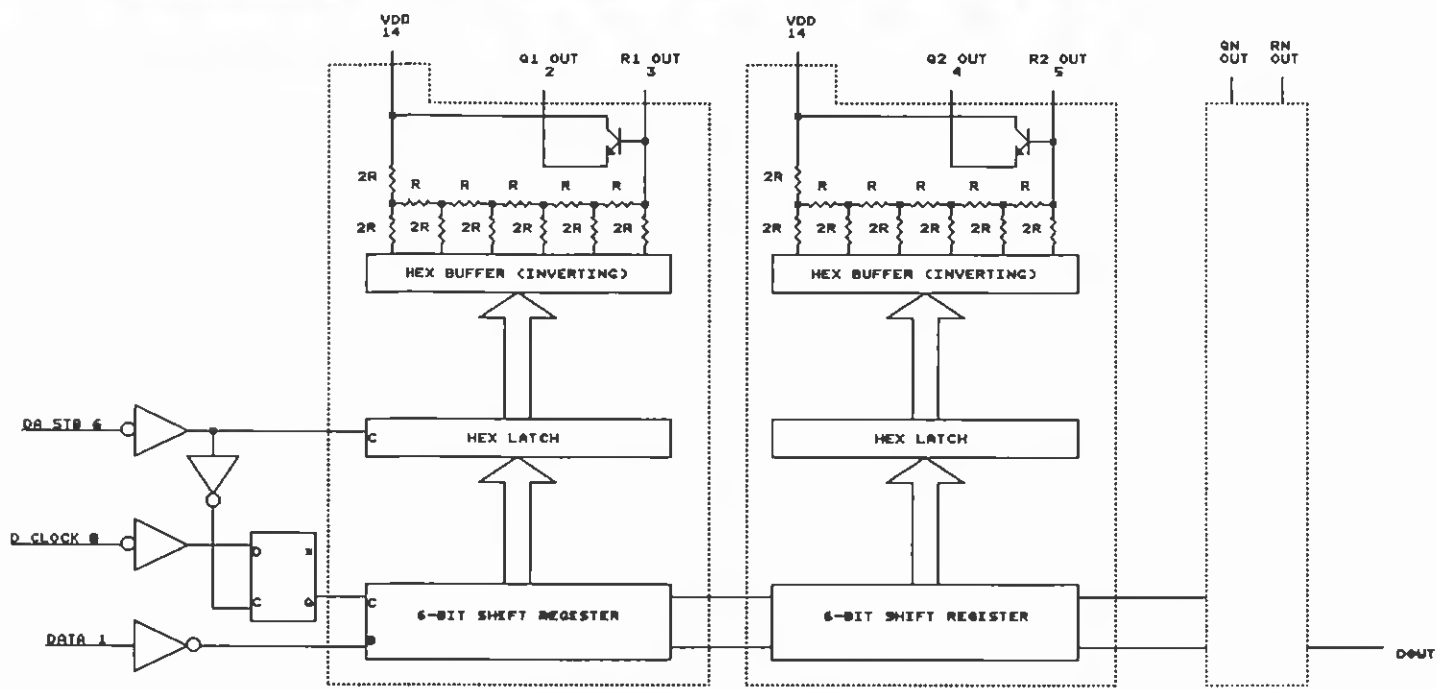
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7

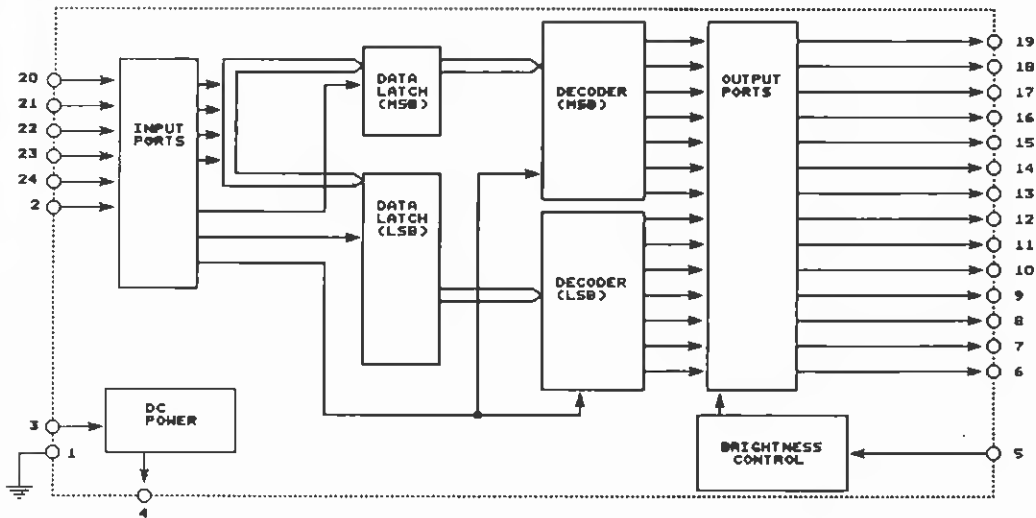
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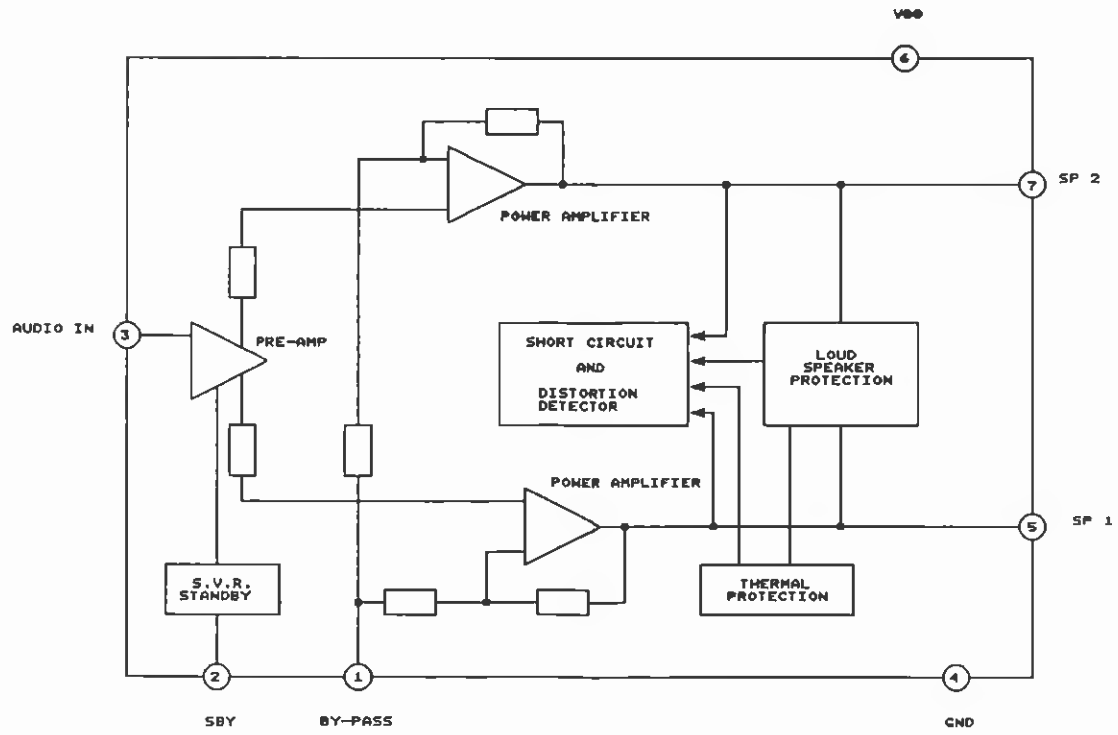
IC241  
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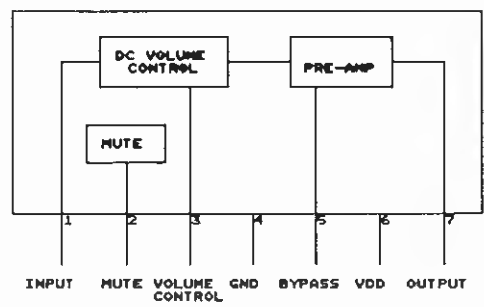
IC404  
MC144111P



IC301  
AN6997K-B

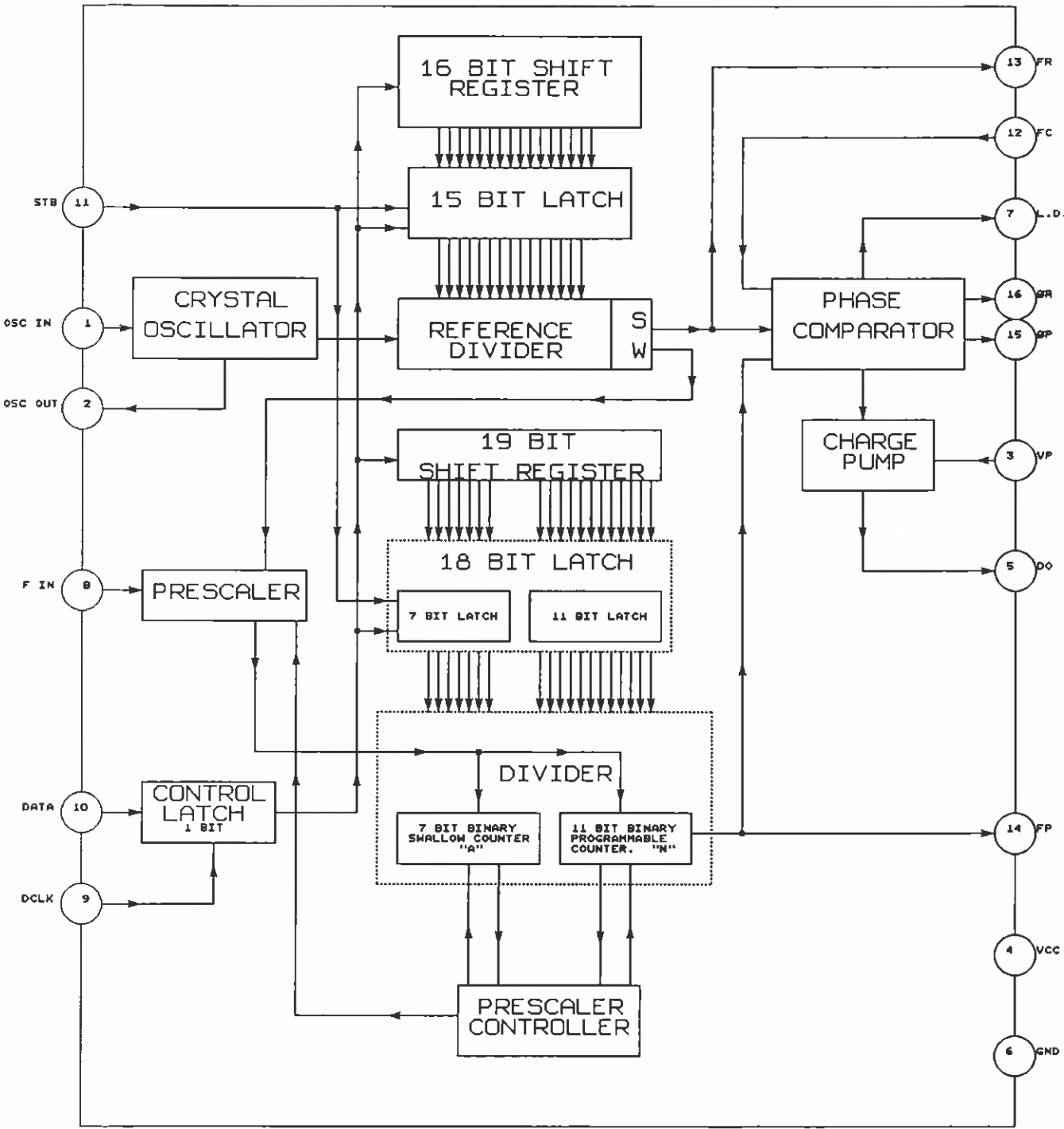


IC406  
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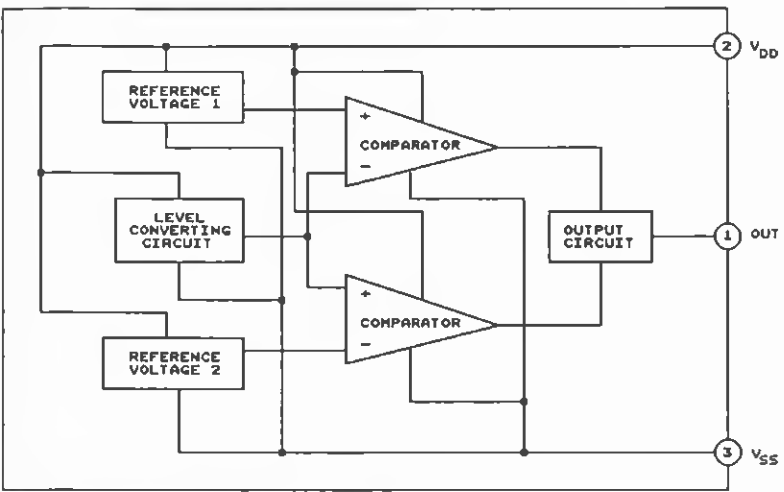
IC408 AND IC409  
AN5262

A	B	C	D	E	F	G	H	I	J	K	L	M
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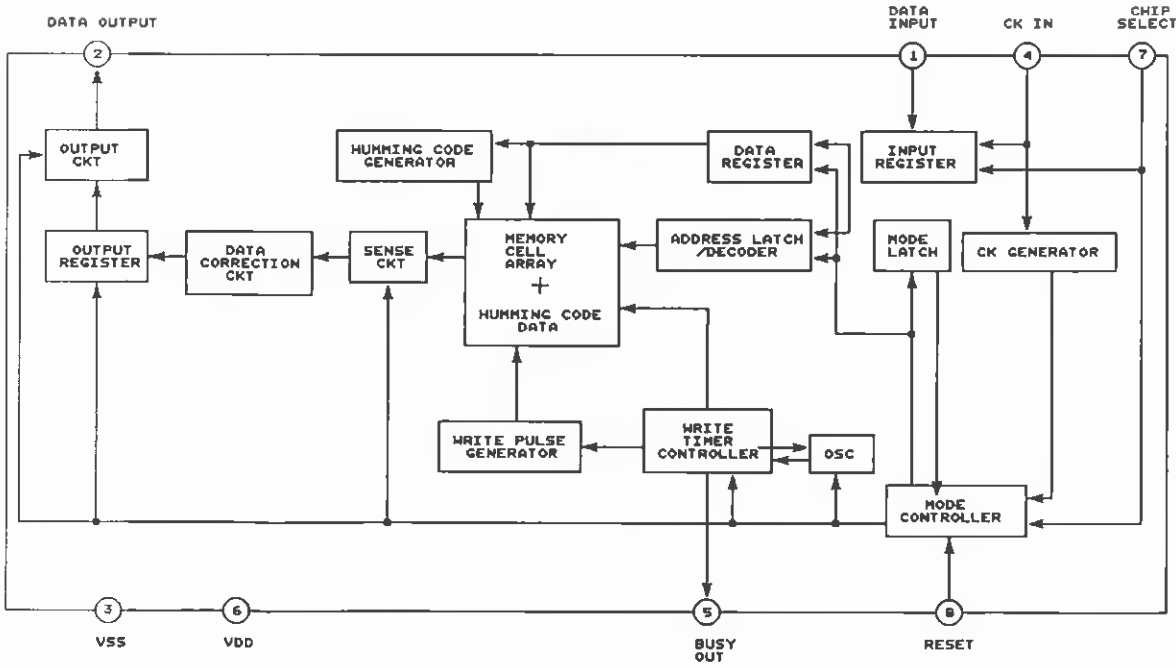
IC771

MB1504



IC902

MN1280R



IC903

M6M80021L

## **SECTION 7**

### **PARTS**

## **PARTS**

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70-1340/1440

## **NOTES**

## MECHANICAL PARTS

REF NO.	DESCRIPTION	PART NO.
1	CHASSIS	70-010261
2	COVER	70-010262
3	ANT PANEL	70-010263
4	CLIP	70-150126
5	ROM PACKING	70-157358
6 TM	BRACKET	70-158323
7 TM	CAP	70-150127
9	DUST PACKING	70-157372
11	PA SHIELD CASE	70-089339
12	PA SHIELD COVER	70-089340
13	VCO SHIELD CASE	70-089341
14	VCO SHIELD COVER	70-089342
15	LOG SHIELD CASE	70-089343
16	LOG SHIELD COVER	70-089344
17	IF SHIELD COVER	70-089348
18	GROUND LUG	70-151271
20	SPACER	70-150149
21	FRONT COVER	70-010264
22 UD	FRONT COVER	70-010268
23 UD	SP BRACKET	70-158324
24	VOLUME KNOB	70-110066
25	VOLUME KNOB	70-110067
28	SWITCH BUTTON	70-110068
32 TM	CONT CASE ASSY	70-010260
33 TM	CONT CHASSIS	70-010267
34 TM	CONT COVER	70-010268
35 TM	CONT BRACKET	70-148329
36 TM	COIN SCREW	70-150130
37 TM	FIBER WASHER	70-151367
38 TM	RUBBER WASHER	70-151364
39	PCB GUIDE	70-150140
40	VOLUME BRACKET	70-158326
42	LED SPACER	70-150133
43 TM	HANDLE	70-158325
46 TM	HANDLE BASE	70-150132
48 TM	BRACKET ASSY	70-158326
50 UD	BRACKET ASSY	70-158327
53	WASHER	70-150477
101	SCREW PLAX PAN HD M3x10	70-150138
105 TM	SCREW SEM9 PAN HD M2x14	70-150131
108	SCREW PAN HD M3x8	70-150128
109 UD	FIXED SCREW	70-000012
110 TM	FIXED SCREW	70-000013
111	SCREW BIND HD M3 x 8	70-150436

# PARTS

70-1340/1440

## TR-1517 BOARD

70-1340/1440 A BAND 70-1340/1440 B BAND			USE "A" USE "B"		
REF NO.	DESCRIPTION	PART NO.	REF NO.	DESCRIPTION	PART NO.
CAPACITORS			CAPACITORS (CONTINUED)		
C102	47 pF, 50 V, CER	70-138344	C259	0.1 $\mu$ F, 25 V, CER	70-138327
C103	15 pF, 50 V, CER	70-138255	C260	1000 pF, 50 V, CER	70-138170
C104	100 pF, 50 V, CER	70-138345	C261	0.01 $\mu$ F, 50 V, CER	70-138270
C106	22 pF, 50 V, CER	70-138171	C262	0.01 $\mu$ F, 50 V, CER	70-138270
C107	27 pF, 50 V, CER	70-138165	C263	120 $\mu$ F, 16 V, AL ELYC	70-135187
C108	0.022 $\mu$ F, 25 V, CER	70-138162	C264	1000 pF, 50 V, CER	70-138170
C109	1000 pF, 50 V, CER	70-138170	C265	4700 pF, 50 V, CER	70-138163
C110	10 pF, 50 V, CER	70-138330	C266	0.01 $\mu$ F, 50 V, CER	70-138270
C111	0.022 $\mu$ F, 25 V, CER	70-138162	C267	0.01 $\mu$ F, 50 V, CER	70-138270
C112	0.022 $\mu$ F, 25 V, CER	70-138162	C268	0.022 $\mu$ F, 25 V, CER	70-138162
C113	47 pF, 50 V, CER	70-138344	C269	0.01 $\mu$ F, 50 V, CER	70-138270
C114	47 pF, 50 V, CER	70-138344	C270	0.022 $\mu$ F, 25 V, CER	70-138162
C115	1000 pF, 50 V, CER	70-138170	C271	0.01 $\mu$ F, 50 V, CER	70-138270
C116	0.022 pF, 25 V, CER	70-138162	C272	1000 pF, 50 V, CER	70-138170
C117	120 $\mu$ F, 50 V, CER	70-138303	C273	0.047 $\mu$ F, 50 V, CER	70-131298
C118	120 pF, 50 V, CER	70-138303	C274 A	0.01 $\mu$ F, 50 V, CER	70-138270
C119	1000 pF, 50 V, CER	70-138170	C274 B	4700 pF, 50 V, CER	70-138163
C122	1000 pF, 50 V, CER	70-138170	C275	1.0 $\mu$ F, 35 V, TA ELYC	70-138067
C131	0.022 $\mu$ F, 25 V, CER	70-138162	C276	0.01 $\mu$ F, 50 V, CER	70-138270
C132	1000 pF, 50 V, CER	70-138170	C277	1000 pF, 50 V, CER	70-138170
C133	1000 pF, 50 V, CER	70-138170	C278	1 $\mu$ F, 50 V, AL ELYC	70-135147
C134 A	33 pF, 50 V, CER	70-138168	C283	47 $\mu$ F, 25 V, AL ELYC	70-135144
C134 B	27 pF, 50 V, CER	70-138165	C284	0.01 $\mu$ F, 50 V, CER	70-138270
C136	22 pF, 50 V, CER	70-138171	C285	220 $\mu$ F, 25 V, AL ELYC	70-131300
C137	22 pF, 50 V, CER	70-138171	C401	0.1 $\mu$ F, 25 V, CER	70-138327
C201 A	39 pF, 50 V, CER	70-138233	C403	220 pF, 50 V, CER	70-138176
C201 B	33 pF, 50 V, CER	70-138168	C404	10 $\mu$ F, 16 V, AL ELYC	70-138161
C202	16 pF, 50 V, CER	70-138206	C406	10 $\mu$ F, 16 V, AL ELYC	70-138161
C203 A	8 pF, 50 V, CER	70-138203	C407	0.047 $\mu$ F, 50 V, CER	70-138350
C203 B	6 pF, 50 V, CER	70-138210	C408	1 $\mu$ F, 50 V, AL ELYC	70-138164
C204 A	7 pF, 50 V, CER	70-138161	C409	220 $\mu$ F, 16 V, AL ELYC	70-135164
C204 B	6 pF, 50 V, CER	70-138203	C410	220 $\mu$ F, 10 V AL ELECT	70-135217
C205 A	33 pF, 50 V, CER	70-138168	C411	0.022 $\mu$ F, 50 V, CER	70-138351
C205 B	39 pF, 50 V, CER	70-138233	C412	10 $\mu$ F, 16 V, AL ELYC	70-138191
C206 B	10 pF, 50 V, CER	70-138330	C413	10 $\mu$ F, 16 V, AL ELYC	70-138191
C207 B	27 pF, 50 V, CER	70-138165	C414	10 $\mu$ F, 16 V, AL ELYC	70-138191
C207 A	39 pF, 50 V, CER	70-138233	C415	10 $\mu$ F, 16 V, AL ELYC	70-138191
C208 A	39 pF, 50 V, CER	70-138233	C416	82 pF, 50 V, CER	70-138250
C208 B	33 pF, 50 V, CER	70-138168	C417	0.01 $\mu$ F, 50 V, CER	70-138270
C209 A	100 pF, 50 V, CER	70-138175	C422	220 $\mu$ F, 25 V, AL ELYC	70-135168
C209 B	82 pF, 50 V, CER	70-138250	C423	10 $\mu$ F, 16 V, AL ELYC	70-138191
C210 A	27 pF, 50 V, CER	70-138165	C424	10 $\mu$ F, 16 V, AL ELYC	70-138191
C210 B	22 pF, 50 V, CER	70-138171	C425	1000 pF, 50 V, CER	70-138170
C211 A	120 pF, 50 V, CER	70-138303	C426	0.01 $\mu$ F, 50 V, CER	70-138270
C211 B	100 pF, 50 V, CER	70-138175	C428	0.1 $\mu$ F, 25 V, CER	70-138327
C212 A	27 pF, 50 V, CER	70-138165	C429	0.1 $\mu$ F, 25 V, CER	70-138327
C212 B	22 pF, 50 V, CER	70-138171	C430	0.1 $\mu$ F, 25 V, CER	70-138327
C213 A	100 pF, 50 V, CER	70-138175	C431	1 $\mu$ F, 50 V, AL ELYC	70-138194
C213 B	82 pF, 50 V, CER	70-138250	C432	22 $\mu$ F, 16 V, AL ELYC	70-135220
C214 A	39 pF, 50 V, CER	70-138233	C433	22 $\mu$ F, 16 V, AL ELYC	70-135220
C214 B	27 pF, 50 V, CER	70-138165	C434	2200 $\mu$ F, 25 V, AL ELYC	70-135218
C215	39 pF, 50 V, CER	70-138233	C436	220 $\mu$ F, 10 V AL ELECT	70-135217
C216 B	0.022 $\mu$ F, 25 V, CER	70-138162	C441	0.1 $\mu$ F, 25 V, CER	70-138327
C217 B	1000 pF, 50 V, CER	70-138170	C442	0.1 $\mu$ F, 25 V, CER	70-138327
C231	1000 pF, 50 V, CER	70-138170	C443	0.01 $\mu$ F, 50 V, CER	70-138270
C232 A	27 pF, 50 V, CER	70-138165	C446	1000 pF, 50 V, CER	70-138170
C232 B	33 pF, 50 V, CER	70-138168	C448	0.1 $\mu$ F, 25 V, CER	70-138327
C233	1000 pF, 50 V, CER	70-138170	C449	47 $\mu$ F, 16 V, TA ELYC	70-135149
C235	56 pF, 50 V, CER	70-138254	C450	1000 pF, 50 V, CER	70-138170
C237	15 pF, 50 V, CER	70-138205	C451	82 pF, 50 V, CER	70-138250
C238	22 pF, 50 V, CER	70-138171	C452	0.022 $\mu$ F, 25 V, CER	70-135253
C239	0.022 $\mu$ F, 25 V, CER	70-138162	C457	220 pF, 50 V, CER	70-138348
C241	27 pF, 50 V, CER	70-138165	C458	220 pF, 50 V, CER	70-138348
C242	27 pF, 50 V, CER	70-138165	C461	10 $\mu$ F, 16 V, AL ELYC	70-138191
C243	82 pF, 50 V, CER	70-138250	C462	10 $\mu$ F, 16 V, AL ELYC	70-138191
C244	330 pF, 50 V, CER	70-138226	C465	100 pF, 50 V, CER	70-138175
C245	0.01 $\mu$ F, 50 V, CER	70-138270	C466	220 pF, 50 V, CER	70-138348
C246	10 pF, 50 V, CER	70-138348	C467	0.1 $\mu$ F, 25 V, CER	70-138327
C247	0.01 $\mu$ F, 50 V, CER	70-138270	C468	4.7 $\mu$ F, 35 V, TA, ELYC	70-138327
C248	12 pF, 50 V, CER	70-138347	C502 A	56 pF, 50 V, CER	70-138254
C249	10 pF, 50 V, CER	70-138346	C503	15 pF, 50 V, CER	70-138205
C250	8 pF, 50 V, CER	70-138203	C504 A	56 pF, 50 V, CER	70-138254
C251	0.01 $\mu$ F, 50 V, CER	70-138270	C504 B	68 pF, 50 V, CER	70-138226
C252	0.01 $\mu$ F, 50 V, CER	70-138270	C505 A	47 pF, 50 V, CER	70-138165
C253	0.01 $\mu$ F, 50 V, CER	70-138270	C505 B	33 pF, 50 V, CER	70-138165
C255	8 pF, 50 V, CER	70-138203	C506 A	100 pF, 50 V, CER	70-132051
C256	6 pF, 50 V, CER	70-138348	C506 B	120 pF, 50 V, CER	70-132057
C258	0.1 $\mu$ F, 25 V, CER	70-138327	C507 A	120 pF, 500 V, CER	70-138306



## TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.	REF NO.	DESCRIPTION	PART NO.
CAPACITORS (CONTINUED))			CAPACITORS (CONTINUED)		
C507 B	150 pF, 100 V, CER	70-138258	C721	2 pF, 50 V, CER	70-138189
C508	220 pF, 100 V, MICA	70-138112	C722	1000 pF, 50 V, CER	70-138170
C508 A	220 pF, 100 V, CER	70-138261	C723	0.022 $\mu$ F, 25 V, CER	70-138182
C509 B	150 pF, 100 V, CER	70-138258	C724	0.022 $\mu$ F, 25 V, CER	70-138162
C510 A	22 pF, 500 V, CER	70-138263	C725	1000 pF, 50 V, CER	70-138170
C510 B	33 pF, 100 V, CER	70-138262	C726	1000 pF, 50 V, CER	70-138170
C512 A	100 pF, 500 V, CER	70-138264	C727	10 pF, 50 V, CER	70-138187
C512 B	82 pF, 500 V, CER	70-138269	C729	22 pF, 50 V, CER	70-138171
C513 A	150 pF, 100 V, MICA	70-138111	C730	100 pF, 50 V, CER	70-138175
C513 B	220 pF, 100 V, MICA	70-138112	C731	1000 pF, 50 V, CER	70-138170
C514 A	82 pF, 500 V, CER	70-138269	C732	39 pF, 50 V, CER	70-138233
C514 B	47 pF, 500 V, CER	70-138268	C733 A	1 pF, 50 V, CER	70-138174
C515 A	10 pF, 500 V, CER	70-138353	C733 B	4 pF, 50 V, CER	70-138179
C515 B	12 pF, 500 V, CER	70-138266	C734	100 pF, 50 V, CER	70-138230
C516	27 pF, 500 V, CER	70-138305	C735 A	2 pF, 50 V, CER	70-138169
C517 A	33 pF, 500 V, CER	70-138262	C735 B	4 pF, 50 V, CER	70-138179
C517 B	27 pF, 500 V, CER	70-138305	C736 A	15 pF, 50 V, CER	70-138205
C518 A	33 pF, 500 V, CER	70-138262	C736 B	22 pF, 50 V, CER	70-138171
C518 B	27 pF, 500 V, CER	70-138305	C737	1000 pF, 50 V, CER	70-138170
C519	12 pF, 500 V, CER	70-138382	C738	1000 pF, 50 V, CER	70-138170
C520	33 pF, 500 V, CER	70-138262	C739 A	15 pF, 50 V, CER	70-138205
C521	22 pF, 50 V, CER	70-138171	C739 B	10 pF, 50 V, CER	70-138187
C522	8 pF, 50 V, CER	70-138210	C740 A	15 pF, 50 V, CER	70-138205
C523	1000 pF, 50 V, CER	70-138170	C740 B	10 pF, 50 V, CER	70-138187
C524	1000 pF, 50 V, CER	70-138170	C741	2 pF, 50 V, CER	70-138169
C526	1000 pF, 50 V, CER	70-138170	C742	0.022 $\mu$ F, 25 V, CER	70-138182
C527	1000 pF, 50 V, CER	70-138170	C743	1000 pF, 50 V, CER	70-138170
C528	0.1 $\mu$ F, 25 V, CER	70-138327	C744	0.022 $\mu$ F, 25 V, CER	70-138182
C529	0.022 $\mu$ F, 50 V, CER	70-138253	C745	1000 pF, 50 V, CER	70-138170
C531	1000 pF, 100 V, CER	70-138239	C746	1000 pF, 50 V, CER	70-138170
C533	0.01 $\mu$ F, 50 V, CER	70-131287	C747	8 pF, 50 V, CER	70-138210
C534	10 $\mu$ F, 50 V, CER	70-135142	C748	22 pF, 50 V, CER	70-138171
C535	1000 pF, 100 V, CER	70-138239	C750	100 pF, 50 V, CER	70-138175
C536	0.047 $\mu$ F, 50 V, CER	70-131298	C751	3 pF, 50 V, CER	70-138184
C537	15 $\mu$ F, 25 V, AL ELYC	70-135154	C752 A	18 pF, 50 V, CER	70-138205
C538	10 $\mu$ F, 50 V, AL ELYC	70-135142	C752 B	1000 pF, 50 V, CER	70-131205
C539	1000 pF, 50 V, CER	70-138073	C753	1000 pF, 50 V, CER	70-138170
C540	1000 pF, 50 V, CER	70-138073	C754	18 pF, 50 V, CER	70-138557
C542	1000 pF, 50 V, CER	70-138170	C755	1000 pF, 50 V, CER	70-138170
C545	1000 pF, 50 V, CER	70-138170	C756	3 pF, 50 V, CER	70-138184
C546	1000 pF, 50 V, CER	70-138170	C758	2 pF, 50 V, CER	70-138169
C547	1000 pF, 50 V, CER	70-138170	C759	2 pF, 50 V, CER	70-138169
C548	1000 pF, 50 V, CER	70-138170	C760	1000 pF, 50 V, CER	70-138170
C549	1000 pF, 50 V, CER	70-138170	C761	1000 pF, 50 V, CER	70-138170
C550	1000 pF, 50 V, CER	70-138170	C762 A	4 pF, 50 V, CER	70-138179
C554	0.1 $\mu$ F, 25 V, CER	70-138327	C762 B	100 pF, 50 V, CER	70-138175
C555	33 pF, 50 V, CER	70-131182	C763	100 pF, 50 V, CER	70-138175
C557	27 pF, 50 V, CER	70-138165	C765	1000 pF, 50 V, CER	70-138170
C558 A	47 pF, 100 V, MICA	70-138114	C766	1000 pF, 50 V, CER	70-138170
C558 B	27 pF, 500 V, MICA	70-138305	C767	1000 pF, 50 V, CER	70-138170
C559 A	180 pF, 100 V, MICA	70-138113	C768	2 pF, 50 V, CER	70-138169
C559 B	150 pF, 500 V, CER	70-138111	C769 A	39 pF, 50 V, CER	70-138233
C560	1000 pF, 100 V, CER	70-138239	C769 B	27 pF, 50 V, CER	70-138185
C561	10 $\mu$ F, 25 V, AL ELYC	70-135173	C770 A	4 pF, 50 V, CER	70-138179
C563	1000 pF, 100 V, CER	70-138239	C770 B	3 pF, 50 V, CER	70-138184
C564	1000 pF, 50 V, CER	70-138170	C771	0.022 $\mu$ F, 25 V, CER	70-138162
C565 B	1000 pF, 100 V, CER	70-138239	C772	0.1 $\mu$ F, 25 V, CER	70-138327
C567	1000 pF, 100 V, CER	70-138239	C773	4 pF, 50 V, CER	70-138179
C569 B	220 pF, 100 V, CER	70-138261	C775	0.022 $\mu$ F, 25 V, CER	70-138182
C570	2200 $\mu$ F, 25 V, AL ELYC	70-138218	C776	47 $\mu$ F, 25 V, AL ELYC	70-135144
C571	1000 pF, 50 V, CER	70-138170	C777	1000 pF, 50 V, CER	70-138170
C573 A	22 pF, 100 V, CER	70-138282	C778	0.022 $\mu$ F, 25 V, CER	70-138182
C573 B	33 pF, 500 V, CER	70-138262	C779	0.1 $\mu$ F, 50 V, PLASTIC	70-138189
C701	47 $\mu$ F, 16 V, AL ELYC	70-135219	C781	1000 pF, 50 V, CER	70-138170
C702	0.022 $\mu$ F, 25 V, CER	70-138162	C782	1 $\mu$ F, 63 V, FILM	70-137101
C703	1000 pF, 50 V, CER	70-138170	C783	0.022 $\mu$ F, 25 V, CER	70-138182
C711	1000 pF, 50 V, CER	70-138170	C784	0.1 $\mu$ F, 50 V, PLASTIC	70-138189
C712 A	27 pF, 50 V, CER	70-138165	C785	0.022 $\mu$ F, 25 V, CER	70-138182
C712 B	22 pF, 50 V, CER	70-138171	C787	1000 pF, 50 V, CER	70-138170
C713 A	4 pF, 50 V, CER	70-138179	C788	1000 pF, 50 V, CER	70-138170
C713 B	8 pF, 50 V, CER	70-138210	C789 B	5 pF, 50 V, CER	70-138166
C714 A	2200 pF, 50 V, CER	70-138185	C790 B	2 pF, 50 V, CER	70-138169
C714 B	1000 pF, 50 V, CER	70-138170	C821	0.022 $\mu$ F, 25 V, CER	70-138182
C715	2 pF, 50 V, CER	70-138169	C823	1000 pF, 50 V, CER	70-138170
C716	15 pF, 50 V, CER	70-138205	C824	0.01 $\mu$ F, 50 V, CER	70-138270
C717	1000 pF, 50 V, CER	70-138170	C825	0.01 $\mu$ F, 50 V, CER	70-138270
C718	1000 pF, 50 V, CER	70-138170	C826	1000 pF, 50 V, CER	70-138170
C719 A	15 pF, 50 V, CER	70-138205	C827	1000 pF, 50 V, CER	70-138170
C719 B	10 pF, 50 V, CER	70-138187	C828	1000 pF, 50 V, CER	70-138170
C720 A	15 pF, 50 V, CER	70-138205	C829	22 pF, 50 V, CER	70-138171
C720 B	10 pF, 50 V, CER	70-138187	C830	47 pF, 50 V, CER	70-138344

# PARTS

70-1340/1440

## TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.	REF NO.	DESCRIPTION	PART NO.
CAPACITORS (CONTINUED)			JACKS (CONTINUED)		
C831	10 $\mu$ F, 16 V, AL ELYC	70-138181	J408	JM16LS-10BAT	70-158563
C832	10 $\mu$ F, 16 V, AL ELYC	70-138181	J410	IL-Y-10P-S15T2-EF	70-158564
C833	1000 pF, 50 V, CER	70-138170	J411	IL-B-15P-S2T2-EF	70-158425
C835	0.022 $\mu$ F, 25 V, CER	70-135253	J413	EMCS0552M	70-158083
C836	0.01 $\mu$ F, 50 V, CER	70-138270	J414	IL-G-2P-S3TS-E	70-158585
VARIABLE CAPACITORS			J420	IL-Y-4P-S15T2-EF	70-158586
CV501	2222-808-32408	70-123024	J501	M-RM	70-158080
DIODES			JUMPERS		
D101	KV1430TR01-34	70-085312	JP1	0 OHM, 1/10 W, MET	70-144108
D102	KV1430TR01-34	70-085312	JP2	0 OHM, 1/10 W, MET	70-144108
D201	DCC010-TA	70-085313	JP3	0 OHM, 1/10 W, MET	70-144108
D202	ND487C2-3R	70-085228	JP4	0 OHM, 1/10 W, MET	70-144108
D241	DCA010-TA	70-085250	JP5	0 OHM, 1/10 W, MET	70-144108
D242	MA3068-M TW	70-085273	JP6	0 OHM, 1/10 W, MET	70-144108
D243 A	DCC010-TA	70-085313	JP7	0 OHM, 1/10 W, MET	70-144108
D243 B	HSM88S	70-085154	JP8	0 OHM, 1/10 W, MET	70-144108
D244	DCA010-TA	70-085250	JP9	0 OHM, 1/10 W, MET	70-144108
D401	IMN10	70-085314	JP10	0 OHM, 1/10 W, MET	70-144108
D501	MI407	70-085047	JP11	0 OHM, 1/10 W, MET	70-144108
D502	HSM88S	70-085154	JP12	0 OHM, 1/10 W, MET	70-144108
D503	MI407	70-085047	COILS AND INDUCTORS		
D504	MA704A	70-085247	L101	42L080	70-090462
D505	RM4AM	70-085282	L132	LQN2AR22K	70-090463
D701	DCA010-TA	70-085250	L133	LQN2A47NM	70-090464
D702	DCA010-TA	70-085250	L201	L-1S7-M1, 4.5 T	70-090465
D711	KV1430TR01-34	70-085312	L202	L-1S7-M1, 4.5 T	70-090465
D713	MA704A	70-085247	L203	L-1S7-M1, 4.5 T	70-090465
D731	KV1430TR01-34	70-085312	L204	L-1S7-M1, 4.5 T	70-090465
D733	MA704A	70-085247	L205	L-1S7-M1, 4.5 T	70-090465
D734	1SV168	70-085159	L208	L-1S7-M1, 4.5 T	70-090465
D735	1SV168	70-085159	L208	ELESN4R7KA	70-090466
D771	DCB010-TA	70-085245	L208	17L004	70-090114
D801	DCB010-TA	70-085245	L210	17L004	70-090114
D802	DCA010-TA	70-085250	L231	LQN2AR22K	70-090463
D803 A	HZM5 A	70-085315	L232	LQN2A22NM	70-090412
D803 B	HZM5-5B	70-085253	L233	LQN2A22NM	70-090412
D804 A	DCB010-TA	70-085245	L241	ELESN4R7MA	70-090468
D804 B	DCA010	70-085250	L242	ELESN4R7MA	70-090468
D805	DWA010-TF	70-085248	L243	ELESN4R22MA	70-090469
D808	HZM5C-TR	70-085251	L244	ELESN4R7KA	70-090468
D807	DCA010-TA	70-085250	L245	24L113	70-090470
FILTERS			L246	42L081	70-090471
FL241	45N14BA 45.000 MHz	70-178081	L247	24L116	70-090472
FL242	45N14BA 45.000 MHz	70-178081	L248	24L115	70-090473
FL243	CFU455E2	70-178019	L250	41L001	70-090423
FL244	CFU-455D2	70-178018	L251	ELESN102KA	70-090474
INTEGRATED CIRCUITS			L253	ELESN331KA	70-090478
IC241	MC3381P	70-078454	L254	ELESN331KA	70-090478
IC401	AN8541	70-078488	L256	ELESN4R7KA	70-090475
IC402	HA17805W	70-078567	L401	1.0 MH	70-178057
IC404	MC144111P	70-078568	L402	ELESN4R7KA	70-090475
IC405	BA728F	70-078569	L501	S4.5T	70-090478
IC408	TDA7240AV	70-078570	L502	S4.5T	70-090486
IC408	AN5262	70-078571	L503 A	S3.5T	70-090481
IC409	AN5262	70-078571	L503 B	S4.5T	70-090489
IC411	BA14741AF	70-078738	L504	C3.5T	70-090495
IC412	F188A3120	70-078208	L505	ELESN1ROMA	70-090480
IC771	MB1504-TF	70-078572	L506	BL02RN1-R82	70-090122
IC772	BU4086BF-T1	70-078573	L508	S4.5T	70-090469
IC801	M37451M4-408SP	70-078831	L509 A	C3.5T	70-090485
IC802	MN1280R	70-078575	L509 B	Z0.8C3D 0.5T	70-090485
IC803	M8M8002IL	70-078578	L510 A	CZ.5T	70-090481
JACKS			L510 B	S4.5T	70-090480
J401	IL-8-P-S2T2-EF	70-158558	L511	S4.5T	70-090480
J402	PS-10PE-D4T1-B1	70-158428	L512	BL02RN1-R82	70-090122
J403	53029-0610	70-158559	L513	52L004	70-090127
J404	IL-Y-4P-S15T2-EF	70-158580	L514	C4.5T	70-090488
J407	IL-Y-4P-S15T2-EF	70-158581	L515	C4.5T	70-090488
J408	IL-Y-13P-S15T2-EF	70-158582	L518	C4.5T	70-090488
			L517	C4.5T	70-090488
			L518	C5.5T	70-090188
			L519	C5.5T	70-090188
			L521	ELESN1ROMA	70-090480
			L522	ELESN1ROMA	70-090480
			L523	ELESN1ROMA	70-090480
			L524	Z0.8C4D 3.5 T	70-090099
			L525	CZ.5T	70-090481

## TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.	REF NO.	DESCRIPTION	PART NO.
COILS (CONTINUED)			RESISTORS (CONTINUED)		
L526	CZ.5T	70-080461	R118	10 KOHM, 1/10 W, MET	70-144120
L527	BLD1RN-A62B1	70-080462	R119	100 OHM, 1/10 W, MET	70-145148
L528	BLD1RN-A62	70-080463	R120	100 OHM, 1/10 W, MET	70-145148
L529	BLD1RN-A62	70-080463	R123	220 KOHM, 1/10 W, MET	70-144131
L711	LQH3N2R2M020M00-100	70-080477	R124	47 KOHM, 1/10 W, MET	70-145145
L712	LQH3N2R2M020M00-100	70-080477	R125	47 KOHM, 1/10 W, MET	70-145145
L713	L-187-M1, 2.5 T	70-080501	R131	10 OHM, 1/10 W, MET	70-144115
L714	LQH3N2R2M020M00-100	70-080477	R132	470 OHM, 1/10 W, MET	70-144158
L715	LQH3N2R2M020M00-100	70-080477	R133	10 KOHM, 1/10 W, MET	70-144120
L716	LQN2AR22K	70-080463	R134	0 OHM, 1/10 W, MET	70-144108
L717	LQN2A22NM	70-080412	R135	220 OHM, 1/10 W, MET	70-144184
L719	LQN2A22NM	70-080412	R136	22 OHM, 1/10 W, MET	70-144180
L720	LQN2AR22K	70-080463	R137	220 OHM, 1/10 W, MET	70-144184
L721	LQN2A47NM	70-080464	R201	33 KOHM, 1/10 W, MET	70-144112
L730	L-187-M1, 4.5 T	70-080465	R202	8.2 KOHM, 1/10 W, MET	70-140305
L731	LQH3N2R2M020M00-100	70-080477	R203	10 OHM, 1/10 W, MET	70-144175
L732	LQH3N2R2M020M00-100	70-080477	R205	68 OHM, 1/10 W, MET	70-144114
L733	L-187-M1, 3.5 T	70-080522	R206 A	56 OHM, 1/10 W, MET	70-145142
L734	LQH3N2R2M020M00-100	70-080477	R206 B	47 OHM, 1/10 W, MET	70-145130
L735	LQH3N2R2M020M00-100	70-080477	R231	470 OHM, 1/10 W, MET	70-144158
L737	LQN2A22NM	70-080412	R232	10 KOHM, 1/10 W, MET	70-144120
L771	LQN2A22NM	70-080412	R233	0 OHM, 1/10 W, MET	70-144108
TRANSISTORS			R234	22 OHM, 1/10 W, MET	70-144180
Q101	2SC2602S-TR (OB)	70-080181	R235	270 OHM, 1/10 W, MET	70-144118
Q102	2SC2462-TR (LC)	70-080180	R236	18 OHM, 1/10 W, MET	70-144171
Q131	2SC3357-T2	70-080288	R237	270 OHM, 1/10 W, MET	70-144118
Q201	2SC3356-T2	70-080322	R241	47 OHM, 1/10 W, MET	70-145130
Q203	2SC3357-T2	70-080288	R242	220 OHM, 1/10 W, MET	70-144184
Q241	2SK125	70-080089	R243	3.3 KOHM, 1/10 W, MET	70-144118
Q242	2SK380E	70-080362	R244	10 KOHM, 1/10 W, MET	70-144120
Q243	2SC2462-TR (LC)	70-080180	R245	330 OHM, 1/10 W, MET	70-144184
Q244	2SC2462-TR (LC)	70-080180	R246	3.9 KOHM, 1/10 W, MET	70-145132
Q401	IMX2-T108 (X2)	70-080363	R247 A	33 KOHM, 1/10 W, MET	70-144112
Q403	IMX2-T108 (X2)	70-080363	R247 B	47 KOHM, 1/10 W, MET	70-144231
Q406	2SC2462-TR (LC)	70-080180	R248	22 KOHM, 1/10 W, MET	70-144121
Q408	2SK506	70-080324	R249	150 OHM, 1/10 W, MET	70-144132
Q409	2SC2462-TR (LC)	70-080180	R254	0 OHM, 1/10 W, MET	70-144108
Q410	2SC2462-TR (LC)	70-080180	R255	1.2 KOHM, 1/10 W, MET	70-144187
Q501	2N4427	70-080147	R256	82 KOHM, 1/10 W, MET	70-144173
Q502	2SC1871S	70-080365	R257	47 KOHM, 1/10 W, MET	70-145145
Q503	2SC2830S	70-080366	R258	220 KOHM, 1/10 W, MET	70-144131
Q504	2SB1065Q	70-080367	R259	1 KOHM, 1/10 W, MET	70-144125
Q701	2SC2462C-TR	70-080180	R260 A	2.7 KOHM, 1/10 W, MET	70-144159
Q702	IMB3-T110	70-080364	R260 B	5.8 KOHM, 1/10 W, MET	70-144188
Q703	IMH1-T1	70-080296	R261	3.3 KOHM, 1/10 W, MET	70-144118
Q704	2SA1121SC	70-080159	R262	82 KOHM, 1/10 W, MET	70-144173
Q705	DTC124EK	70-080300	R263	10 KOHM, 1/10 W, MET	70-144120
Q711	3SK151GR	70-080303	R264 A	47 KOHM, 1/10 W, MET	70-145145
Q712	2SC2351	70-080218	R264 B	27 KOHM, 1/10 W, MET	70-145163
Q731	3SK151GR	70-080303	R265	15 KOHM, 1/10 W, MET	70-144122
Q732	2SC2351	70-080218	R266	47 KOHM, 1/10 W, MET	70-145145
Q733	2SC2351	70-080218	R401	270 OHM, 1/4 W, MET	70-144183
Q734	2SC2351	70-080218	R402	22 KOHM, 1/10 W, MET	70-144121
Q771	IMD3-T1	70-080297	R404	33 KOHM, 1/10 W, MET	70-144112
Q772	IMH1-T1	70-080296	R405	1 KOHM, 1/10 W, MET	70-144125
Q773	2SC2462-TR (LC)	70-080180	R406	100 KOHM, 1/10 W, MET	70-145128
Q774	2SA1121C-TR	70-080159	R407	100 KOHM, 1/10 W, MET	70-145128
Q775	2SA1121C-TR	70-080159	R408	100 KOHM, 1/10 W, MET	70-145128
Q776	2SC2462-TR (LC)	70-080180	R409	100 KOHM, 1/10 W, MET	70-145128
Q778	IMH1-T1	70-080296	R410	33 KOHM, 1/10 W, MET	70-144112
RESISTORS			R411	22 KOHM, 1/10 W, MET	70-144121
R101	47 KOHM, 1/10 W, MET	70-145145	R412	10 KOHM, 1/10 W, MET	70-144120
R102	47 KOHM, 1/10 W, MET	70-145145	R413	1 KOHM, 1/10 W, MET	70-144125
R103	47 KOHM, 1/10 W, MET	70-145145	R414	15 KOHM, 1/10 W, MET	70-144122
R104	47 KOHM, 1/10 W, MET	70-145145	R415	150 KOHM, 1/10 W, MET	70-144129
R106	22 KOHM, 1/10 W, MET	70-144121	R416	68 KOHM, 1/10 W, MET	70-144119
R107	1 KOHM, 1/10 W, MET	70-144286	R417	4.7 KOHM, 1/10 W, MET	70-144123
R108	10 KOHM, 1/10 W, MET	70-144120	R418	4.7 KOHM, 1/10 W, MET	70-144123
R109	4.7 KOHM, 1/10 W, MET	70-144123	R419	330 KOHM, 1/10 W, MET	70-140318
R110	2.2 KOHM, 1/10 W, MET	70-144113	R421	22 KOHM, 1/10 W, MET	70-144806
R111	1.5 KOHM, 1/10 W, MET	70-144134	R422	22 KOHM, 1/10 W, MET	70-144121
R112	10 KOHM, 1/10 W, MET	70-144120	R423	100 KOHM, 1/10 W, MET	70-145128
R113	4.7 KOHM, 1/10 W, MET	70-144123	R424 A	100 KOHM, 1/10 W, MET	70-145128
R114	1 KOHM, 1/10 W, MET	70-144125	R424 B	22 KOHM, 1/10 W, MET	70-144806
R115	100 OHM, 1/10 W, MET	70-145146	R425	12 KOHM, 1/10 W, MET	70-144117
R116	100 OHM, 1/10 W, MET	70-145146	R426	1 KOHM, 1/10 W, MET	70-144125
R117	220 OHM, 1/10 W, MET	70-144184	R427	4.7 KOHM, 1/10 W, MET	70-144123
			R428	880 OHM, 1/10 W, MET	70-144157
			R430	1 KOHM, 1/10 W, MET	70-144125
			R431 A	8.2 KOHM, 1/10 W, MET	70-144305
			R431 B	1.5 KOHM, 1/10 W, MET	70-144134

# PARTS

70-1340/1440

## TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.	REF NO.	DESCRIPTION	PART NO.
RESISTORS (CONTINUED)			RESISTORS (CONTINUED)		
R434	15 KOHM, 1/10 W, MET	70-144122	R752	47 KOHM, 1/10 W, MET	70-145145
R435	10 KOHM, 1/10 W, MET	70-144120	R754	8.8 KOHM, 1/10 W, MET	70-144158
R436 A	27 KOHM, 1/10 W, MET	70-144112	R755	2.2 KOHM, 1/10 W, MET	70-144113
R436 B	22 KOHM, 1/10 W, MET	70-144121	R756	100 OHM, 1/10 W, MET	70-145148
R437	10 KOHM, 1/10 W, MET	70-144120	R757	47 OHM, 1/10 W, MET	70-145130
R439	1 KOHM, 1/10 W, MET	70-144125	R758	1 KOHM, 1/10 W, MET	70-144125
R440	150 KOHM, 1/10 W, MET	70-144287	R759	3.3 KOHM, 1/10 W, MET	70-144118
R441	100 KOHM, 1/10 W, MET	70-144288	R760	47 OHM, 1/10 W, MET	70-145130
R442	1 KOHM, 1/10 W, MET	70-144289	R770 A	47 KOHM, 1/10 W, MET	70-141210
R443	39 KOHM, 1/10 W, MET	70-144290	R770 B	47 KOHM, 1/10 W, MET	70-144281
R444	82 KOHM, 1/10 W, MET	70-144291	R771	100 KOHM, 1/10 W, MET	70-145128
R445	100 KOHM, 1/10 W, MET	70-145128	R772	22 OHM, 1/10 W, MET	70-144180
R446	820 OHM, 1/10 W, MET	70-144185	R773	100 KOHM, 1/10 W, MET	70-145128
R447	4.7 KOHM, 1/10 W, MET	70-144123	R774	1 KOHM, 1/10 W, MET	70-144125
R448	10 KOHM, 1/10 W, MET	70-144120	R775	0 OHM, 1/10 W, MET	70-144108
R452	330 OHM, 1/8 W, MET	70-144085	R776	47 KOHM, 1/10 W, MET	70-145145
R454	10 OHM, 1/8 W, MET	70-144088	R777	4.7 KOHM, 1/10 W, MET	70-144123
R455	10 KOHM, 1/10 W, MET	70-144120	R778	10 KOHM, 1/10 W, MET	70-144120
R456	10 KOHM, 1/10 W, MET	70-144120	R779	22 KOHM, 1/10 W, MET	70-144121
R457	2.2 KOHM, 1/10 W, MET	70-144113	R780	0 OHM, 1/10 W, MET	70-144108
R458	330 OHM, 1/10 W, MET	70-144184	R782	4.7 KOHM, 1/10 W, MET	70-144123
R461	1 KOHM, 1/10 W, MET	70-144125	R783	47 KOHM, 1/10 W, MET	70-145145
R462	3.3 KOHM, 1/10 W, MET	70-144118	R784	47 KOHM, 1/10 W, MET	70-145145
R463	580 OHM, 1/10 W, MET	70-144130	R785	100 KOHM, 1/10 W, MET	70-145128
R464	2.7 KOHM, 1/10 W, MET	70-144159	R786	22 KOHM, 1/10 W, MET	70-144121
R465	220 KOHM, 1/10 W, MET	70-145131	R787	100 OHM, 1/10 W, MET	70-145148
R466	47 KOHM, 1/10 W, MET	70-145145	R788	22 OHM, 1/10 W, MET	70-144180
R467	47 KOHM, 1/10 W, MET	70-144231	R789	4.7 KOHM, 1/10 W, MET	70-144123
R470	22 KOHM, 1/10 W, MET	70-144808	R790	1 KOHM, 1/10 W, MET	70-144125
R471	0 OHM, 1/10 W, MET	70-144108	R791 A	2.2 KOHM, 1/10 W, MET	70-144113
R472	22 KOHM, 1/10 W, MET	70-144808	R791 B	1.5 KOHM, 1/10 W, MET	70-144134
R501	0 OHM, 1/10 W, MET	70-144108	R792	4.7 KOHM, 1/10 W, MET	70-144123
R502	220 OHM, 1/10 W, MET	70-144184	R793	47 KOHM, 1/10 W, MET	70-145145
R503	2.7 KOHM, 1/4 W, MET	70-144293	R794 A	1 KOHM, 1/10 W, MET	70-144125
R506	4.7 OHM, 1 W, MET	70-144108	R794 B	1.5 KOHM, 1/10 W, MET	70-144134
R507	100 OHM, 1/8 W, MET	70-144009	R795	47 KOHM, 1/10 W, MET	70-145145
R508	100 OHM, 1/8 W, MET	70-144009	R796	22 KOHM, 1/10 W, MET	70-144121
R509	470 OHM, 1/10 W, MET	70-144158	R797	5.8 KOHM, 1/10 W, MET	70-144188
R510	470 OHM, 1/10 W, MET	70-144158	R798	1 KOHM, 1/10 W, MET	70-144125
R511	470 OHM, 1/10 W, MET	70-144158	R799	2.7 KOHM, 1/10 W, MET	70-144159
R512	100 KOHM, 1/10 W, MET	70-145128	R811	22 KOHM, 1/10 W, MET	70-144121
R513	100 KOHM, 1/10 W, MET	70-145128	R812	22 KOHM, 1/10 W, MET	70-144121
R515	33 OHM, 1/10 W, MET	70-140320	R813	22 KOHM, 1/10 W, MET	70-144121
R516	39 OHM, 1/10 W, MET	70-144124	R814	22 KOHM, 1/10 W, MET	70-144121
R517	1 KOHM, 1/10 W, MET	70-144125	R815	22 KOHM, 1/10 W, MET	70-144121
R518 A	5.8 KOHM, 1/10 W, MET	70-144188	R816	22 KOHM, 1/10 W, MET	70-144121
R518 B	1.5 KOHM, 1/10 W, MET	70-144134	R821	1 KOHM, 1/10 W, MET	70-144125
R520 A	33 OHM, 1 W, MET	70-144201	R822	1 KOHM, 1/10 W, MET	70-144125
R520 B	100 OHM, 1 W, MET	70-144290	R823	1 KOHM, 1/10 W, MET	70-144125
R521	88 OHM, 1/8 W, MET	70-144008	R824	1 KOHM, 1/10 W, MET	70-144125
R522 A	0 OHM, 1/10 W, MET	70-144108	R825	1 KOHM, 1/10 W, MET	70-144125
R523 B	2.2 OHM, 2 W, MET	70-145050	R826	1 KOHM, 1/10 W, MET	70-144125
R525 A	2.2 KOHM, 1/10 W, MET	70-144113	R827	470 OHM, 1/10 W, MET	70-144158
R701	220 OHM, 1/10 W, MET	70-144194	R831	47 KOHM, 1/10 W, MET	70-145145
R702	47 KOHM, 1/10 W, MET	70-145145	R832	47 KOHM, 1/10 W, MET	70-145145
R704	47 KOHM, 1/10 W, MET	70-145145	R833	47 KOHM, 1/10 W, MET	70-145145
R705	47 KOHM, 1/10 W, MET	70-145145	R835	22 KOHM, 1/10 W, MET	70-144121
R706	47 KOHM, 1/10 W, MET	70-145145	R836	0 OHM, 1/10 W, MET	70-144108
R707	220 OHM, 1/10 W, MET	70-144184	R837	1 KOHM, 1/10 W, MET	70-144125
R708	4.7 KOHM, 1/10 W, MET	70-144123	R845	1 KOHM, 1/10 W, MET	70-144125
R711	47 OHM, 1/10 W, MET	70-145130	R846	1 KOHM, 1/10 W, MET	70-144125
R713	10 KOHM, 1/10 W, MET	70-144120	R847	1 KOHM, 1/10 W, MET	70-144125
R714	22 KOHM, 1/10 W, MET	70-144121	R848	1 KOHM, 1/10 W, MET	70-144125
R715	22 KOHM, 1/10 W, MET	70-144121	R849	1 KOHM, 1/10 W, MET	70-144125
R716	22 KOHM, 1/10 W, MET	70-144121	R851	1 KOHM, 1/10 W, MET	70-144125
R717	150 OHM, 1/10 W, MET	70-140321	R852	1 KOHM, 1/10 W, MET	70-144125
R718	8.8 KOHM, 1/10 W, MET	70-144158	R853	1 KOHM, 1/10 W, MET	70-144125
R719	2.2 KOHM, 1/10 W, MET	70-144113	R854	1 KOHM, 1/10 W, MET	70-144125
R720	100 OHM, 1/10 W, MET	70-145148	R855	1 KOHM, 1/10 W, MET	70-144125
R721	47 OHM, 1/10 W, MET	70-145130	R856	1 KOHM, 1/10 W, MET	70-144125
R732	8.8 KOHM, 1/10 W, MET	70-144158	R857	1 KOHM, 1/10 W, MET	70-144125
R734	22 KOHM, 1/10 W, MET	70-144121	R858	0 OHM, 1/10 W, MET	70-144108
R735	22 KOHM, 1/10 W, MET	70-144121	R859	10 KOHM, 1/10 W, MET	70-144120
R736	22 KOHM, 1/10 W, MET	70-144121	R861	1 KOHM, 1/10 W, MET	70-144125
R737	150 OHM, 1/10 W, MET	70-140321	R863	1 KOHM, 1/10 W, MET	70-144125
R738	8.8 KOHM, 1/10 W, MET	70-144158	R864	22 KOHM, 1/10 W, MET	70-144121
R739	2.2 KOHM, 1/10 W, MET	70-144113	R865	1 KOHM, 1/10 W, MET	70-144125
R740	100 OHM, 1/10 W, MET	70-145148	R866	10 KOHM, 1/10 W, MET	70-144120
R741	47 OHM, 1/10 W, MET	70-145130	R867	22 KOHM, 1/10 W, MET	70-144121
R742	47 OHM, 1/10 W, MET	70-145130	R868	10 KOHM, 1/10 W, MET	70-144120
R751	47 KOHM, 1/10 W, MET	70-145145	R871	47 KOHM, 1/10 W, MET	70-145145

## TR-1517 BOARD (CONTINUED)

REF NO.	DESCRIPTION	PART NO.	REF NO.	DESCRIPTION	PART NO.
RESISTORS (CONTINUED)			VARIABLE RESISTORS		
R972	320 OHM, 1/10 W, MET	70-145185	RV241	082KCJ3 (2.2 k)	70-184108
R973	820 OHM, 1/10 W, MET	70-145185	RV401	100 KOHM	70-184110
R974	820 OHM, 1/10 W, MET	70-145185			
R975 A	100 KOHM, 1/10 W, MET	70-144128	CRYSTALS		
R975 B	1 KOHM, 1/10 W, MET	70-144125			
R976 A	47 KOHM, 1/10 W, MET	70-145145	X101	XTAL, HC-4370, 12.8 MHz	70-128087
R976 B	47 KOHM, 1/10 W, MET	70-144231	X241	TXAL UM-1 44.545 MHz	70-128088
R977 A	39 KOHM, 1/10 W, MET	70-144188	X901	XTAL, AT-51 8.000 MHz	70-128089
R977 B	39 KOHM, 1/10 W, MET	70-144290			
R978 A	100 KOHM, 1/10 W, MET	70-145128	MISCELLANEOUS		
R978 B	100 KOHM, 1/10 W, MET	70-144184			
R979	22 KOHM, 1/10 W, MET	70-144121			
R980	10 KOHM, 1/10 W, MET	70-144120			
R981	1 KOHM, 1/10 W, MET	70-144125	CB901	SHIELD CASE	70-089339
R982	1 KOHM, 1/10 W, MET	70-144125	CB902	INSULATION PLATE	70-157357
R983	22 KOHM, 1/10 W, MET	70-144121		C BLOCK EXF P12 1022F	70-089058
R984	1 KOHM, 1/10 W, MET	70-144125		C BLOCK EXF P8 1022F	70-089059
R985 B	4.7 KOHM, 1/10 W, MET	70-144184	CM201	IL-8-2P-S2T2-EF	70-159399
R986 B	4.7 KOHM, 1/10 W, MET	70-144184	CM701	IL-8-2P-S2T2-EF	70-159399
R986	1 MOHM, 1/10 W, MET	70-144155	F501	SSFR 5A	70-204082
R989	1 KOHM, 1/10 W, MET	70-144125	FB501 A	BF03-3.5x5x1.3	70-178088
R991	22 KOHM, 1/10 W, MET	70-144121	P410	CONNECTOR	70-159700
R992	10 KOHM, 1/10 W, MET	70-144120	RC901	RC NETWORK (47 k 1000 p)	70-089080
R996	10 KOHM, 1/10 W, MET	70-144120	RC902	RC NETWORK (10 k 1000 p)	70-089081
R997	100 KOHM, 1/10 W, MET	70-145128			
R998	220 KOHM, 1/10 W, MET	70-144131			

## TRUNK-MOUNT ADAPTOR

70-1340/1440 A BAND USE 'A'			70-1340/1440 B BAND USE 'B'		
REF NO.	DESCRIPTION	PART NO.	REF NO.	DESCRIPTION	PART NO.
CAPACITORS			CONNECTORS		
C311	0.01 $\mu$ F 50 V CER	70-138270	J311	D3431	70-159682
C312	0.01 $\mu$ F 50 V CER	70-138270			
C313	0.01 $\mu$ F 50 V CER	70-138270	JUMPERS		
C314	0.01 $\mu$ F 50 V CER	70-138270			
C315	0.01 $\mu$ F 50 V CER	70-138270	JP311	0 OHM 1/10 W MET	70-144108
C317	0.01 $\mu$ F 50 V CER	70-138270	JP312	0 OHM 1/10 W MET	70-144108
C318	0.01 $\mu$ F 50 V CER	70-138270	JP313	0 OHM 1/10 W MET	70-144108
C319	0.01 $\mu$ F 50 V CER	70-138270	JP316	0 OHM 1/10 W MET	70-144108
C321	0.01 $\mu$ F 50 V CER	70-138270	JP317	0 OHM 1/10 W MET	70-144108
C322	0.01 $\mu$ F 50 V CER	70-138270	JP318	0 OHM 1/10 W MET	70-144108
CABLE ASSEMBLIES			JP319	0 OHM 1/10 W MET	70-144108
CA311	IL-YB-14D-JL-S 14S	70-034827	JP321	0 OHM 1/10 W MET	70-144108
CA312	IL-J-SP-IL-G 2S	70-034828	JP322	0 OHM 1/10 W MET	70-144108
CA313	ILS2P-EMCHUM020 1W L = 150	70-034825	JP323	0 OHM 1/10 W MET	70-144108
CA319	IL-YB-15D-IL-S 15S	70-034568	JP324	0 OHM 1/10 W MET	70-144108
DIODES			RESISTORS		
D311	DCB010	70-085245	R321	47 KOHM 1/10 W MET	70-145145
			SWITCHES		
			S311	RELAY AGP8003	70-105022

## TRUNK-MOUNT SMALL REMOTE ADAPTOR

REF NO.	DESCRIPTION	PART NO.
CA324	CABLE ASSEMBLY 1282R L = 120	70-034830
C326	4.7 $\mu$ F 35 V TANT	70-138088
C331	1000 pF 50 V CER	70-138170
J321	CONNECTOR D3431	70-159593
J322	CONNECTOR	70-159425
J323	CONNECTOR	70-159558
JP331	0 OHM 1/10 W MET	70-144108
JP334	0 OHM 1/10 W MET	70-144108

# PARTS

70-1340/1440

## CONTROL HEAD

70-1340/1440 A BAND 70-1340/1440 B BAND			USE "A" USE "B"		
REF NO.	DESCRIPTION	PART NO.	REF NO.	DESCRIPTION	PART NO.
CAPACITORS			RESISTORS (CONTINUED)		
C301	0.01 $\mu$ F 50 V CER	70-138270	R308	47 k $\Omega$ 1/10 W MET	70-145145
C302	1000 pF 50 V CER	70-138170	R310	47 k $\Omega$ 1/10 W MET	70-145145
C303	0.01 $\mu$ F 50 V CER	70-138270	R311	47 k $\Omega$ 1/10 W MET	70-145145
C304	1 $\mu$ F 50 V AL ELYC	70-138184	R312	220 k $\Omega$ 1/10 W MET	70-144131
C305	1000 pF 50 V CER	70-138170	R313	33 k $\Omega$ 1/10 W MET	70-144112
C306	1000 pF 50 V CER	70-138170	R314	150 $\Omega$ 1/8 W MET	70-144011
C307	470 $\mu$ F, 25 V, AL, ELYC	70-135027	R315	150 $\Omega$ 1/8 W MET	70-144011
CABLE ASSEMBLIES			R317	330 $\Omega$ 1/8 W, MET	70-144184
CA301	SMV2d 15 x 21	70-034820	R318	330 $\Omega$ 1/8 W, MET	70-144184
CA302	SMV2d 3 x 88	70-034821	VARIABLE RESISTORS		
CA303-1	ILYB-15P-ILS 158	70-034822	RV301	K1214005L (10K $\Omega$ )	70-180025
CA303-2	ILYB-14P-ILS 148	70-034823	RV302	K1214105G (10K $\Omega$ )	70-180026
CA304	ILG-25-8387	70-034834	SWITCHES		
DIODES			S301	ESB-84803	70-183080
D301	LED LB 402	70-202088	S302	ESB-84803	70-183080
D302	SLM-245 LMW TE84L	70-085318	S303	ESB-84803	70-183080
D303	SLM-125MT TE84L	70-085317	S304	ESB-84803	70-183080
D304	SLM-125MT TE84L	70-085317	S305	SRBU1C L-15MM	70-183084
D305	SLM-125MT TE84L	70-085317	JACKS		
D306	SLM-125MT TE84L	70-085317	J301	NS1504L	70-158100
INTEGRATED CIRCUITS			J304	IL-G-2P-83T2-EF	70-158565
IC301	AN6887K	70-078577	JUMPERS		
IC302	BU74HC174F-T1	70-078578	JP301	0 $\Omega$ 1/10 W MET	70-144108
TRANSISTORS			JP302	0 $\Omega$ 1/10 W MET	70-144108
Q301	2SA1121C-TR	70-080158	JP303	0 $\Omega$ 1/10 W MET	70-144108
Q302	IMH1-T1	70-080298	JP304	0 $\Omega$ 1/10 W MET	70-144108
Q303	IMH1-T1	70-080298	JP305	0 $\Omega$ 1/10 W MET	70-144108
RESISTORS			JP307	0 $\Omega$ 1/10 W MET	70-144108
R301	1 k $\Omega$ 1/10 W MET	70-144125	JP308	0 $\Omega$ 1/10 W MET	70-144108
R303	270 $\Omega$ 1/10 W MET	70-144118	JP309	0 $\Omega$ 1/10 W MET	70-144108
R304	270 $\Omega$ 1/10 W MET	70-144118	JP310	0 $\Omega$ 1/10 W MET	70-144108
R305	270 $\Omega$ 1/10 W MET	70-144118	MISCELLANEOUS		
R308	270 $\Omega$ 1/10 W MET	70-144118	CD301	PHOTO SENSOR P1201	70-085054
R306	330 k $\Omega$ 1/10 W MET	70-140318			

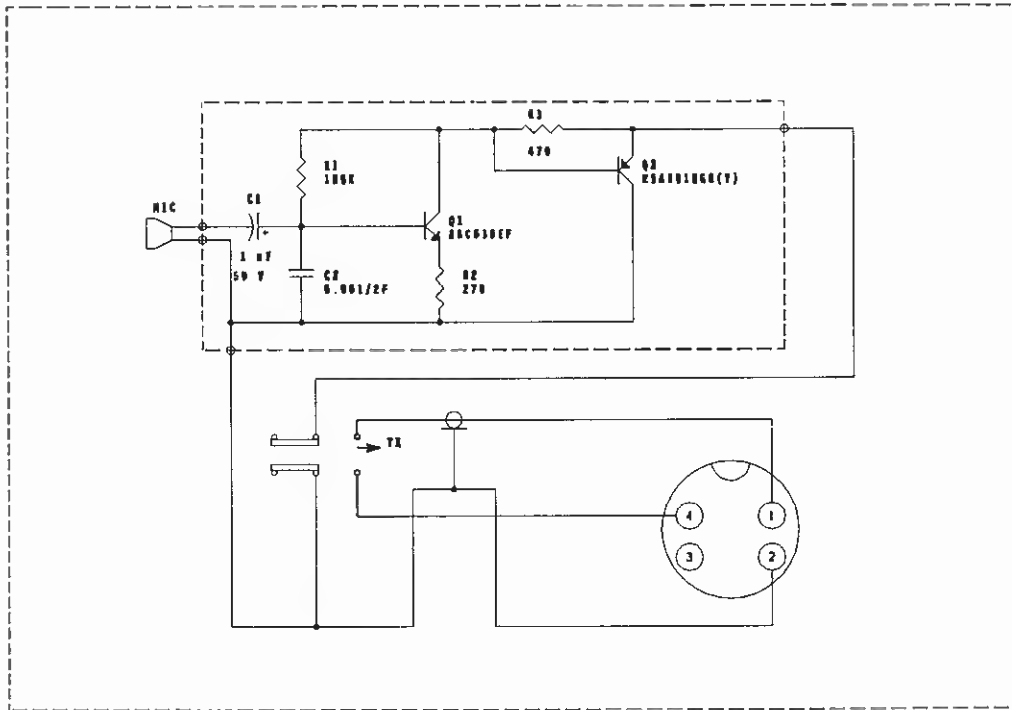
## 70-2157 CTCSS FILTER BOARD

REF NO.	DESCRIPTION	PART NO.
CAPACITORS		
C1	6.3 $\mu$ F, 10 V, AL, ELYC	70-135335
C2	680 pF, 50 V, CER	70-138252
C4	6.3 $\mu$ F, 10 V, AL, ELYC	70-135335
C5	0.1 $\mu$ F, 25 V, CER	70-138327
C6	6.3 $\mu$ F, 10 V, AL, ELYC	70-135336
C7	1 $\mu$ F, 50 V, CER	70-135257
C8	0.022 $\mu$ F, 25 V, CER	70-138182
C9	1500 pF, 50 V, CER	70-138204
C10	1500 pF, 50 V, CER	70-138204
C50	0.01 $\mu$ F, 50 V, CER	70-138270
C51	0.01 $\mu$ F, 25 V, PLAS	70-137128
C52	0.01 $\mu$ F, 25 V, PLAS	70-137128
C53	0.01 $\mu$ F, 25 V, PLAS	70-137128
C54	0.01 $\mu$ F, 25 V, PLAS	70-137128
C55	0.01 $\mu$ F, 25 V, PLAS	70-137128
C56	0.01 $\mu$ F, 25 V, PLAS	70-137128
C57	0.01 $\mu$ F, 25 V, PLAS	70-137128
C58	0.01 $\mu$ F, 25 V, PLAS	70-137128
C59	1 $\mu$ F, 50 V, AL, ELYC	70-135257
C60	0.01 $\mu$ F, 50 V, CER	70-138270
C61	0.01 $\mu$ F, 50 V, CER	70-138270
C62	6.8 $\mu$ F, 10 V, AL, ELYC	70-135335
INTEGRATED CIRCUITS		
IC1	MF6CWM-50-14W	70-076611
IC2	BU4068BF	70-076573
IC50	BA10324F	70-076612
TRANSISTORS		
Q1	2SC2462C	70-080288
Q2	2SC2462C	70-080288
RESISTORS		
R1	10 k $\Omega$ , 1/10 W, MET	70-144120
R2	12 k $\Omega$ , 1/10 W, MET	70-144111
R3	10 k $\Omega$ , 1/10 W, MET	70-144120
R4	100 k $\Omega$ , 1/10 W, MET	70-145128
R5	100 k $\Omega$ , 1/10 W, MET	70-145128
R6	150 k $\Omega$ , 1/10 W, MET	70-144129
R7	120 k $\Omega$ , 1/10 W, MET	70-144310
R8	1 k $\Omega$ , 1/10 W, MET	70-144125
R10	27 k $\Omega$ , 1/10 W, MET	70-144163
R11	470 k $\Omega$ , 1/10 W, MET	70-144189
R12	2.2 k $\Omega$ , 1/10 W, MET	70-144113
R13	22 k $\Omega$ , 1/10 W, MET	70-144121
R14	3.3 k $\Omega$ , 1/10 W, MET	70-144118
R15	1 k $\Omega$ , 1/10 W, MET	70-144125
R16	1 k $\Omega$ , 1/10 W, MET	70-144125
R17	39 k $\Omega$ , 1/10 W, MET	70-144188
R18	22 k $\Omega$ , 1/10 W, MET	70-144121
R20	100 k $\Omega$ , 1/10 W, MET	70-145128
R50	820 $\Omega$ , 1/10 W, MET	70-144185
R51	24 k $\Omega$ , 1/10 W, MET	70-144308
R52	0 $\Omega$ , 1/10 W, MET	70-144108
R53	27 k $\Omega$ , 1/10 W, MET	70-144183
R54	4.3 k $\Omega$ , 1/10 W, MET	70-144307
R55	560 k $\Omega$ , 1/10 W, MET	70-144308
R56	18 k $\Omega$ , 1/10 W, MET	70-144185
R57	58 k $\Omega$ , 1/10 W, MET	70-144189
R58	12 k $\Omega$ , 1/10 W, MET	70-144111
R59	150 k $\Omega$ , 1/10 W, MET	70-144129
R60	270 $\Omega$ , 1/10 W, MET	70-144116
R61	180 k $\Omega$ , 1/10 W, MET	70-144308
R62	100 k $\Omega$ , 1/10 W, MET	70-145128
VARIABLE RESISTORS		
RV1	50 k $\Omega$	70-184158
MISCELLANEOUS		
P403	SCREW BIND HD M26 x 6	70-150169
SP301	CONNECTOR 5513-8CP8	70-159567
	SPEAKER	70-060033

# PARTS

70-1340/1440

## 70-2306 Microphone Schematic and Parts List



REF NO.	DESCRIPTION	PART NO.
Q1	2SC536EF	70-080026
Q2	2SA1015GR(Y)	70-080025
C1	10F, 50 WV, ELECTROLYTIC CAPACITOR	70-135002
C2	CERAMIC CAPACITOR (102)	70-132005
R1	RESISTOR, 170 kΩ, 1/4 W	70-141037
R2	RESISTOR, 270 Ω, 1/4 W	70-141010
R3	RESISTOR, 470 Ω, 1/4 W	70-141016
	ELEMENT, DYNAMIC	70-038004
	P/T SWITCH	70-183004
	P/T KNOB	70-118007
	PCB W COMP	70-075014
	PCB W/O COMP	70-070008
	CUSHION, P/T SWITCH	70-157015
	MIC CORD W/O CONT.	70-034074
	MIC CORD W CONT.	70-034075
	4 PIN MIC PLUG	70-158015
	RUBBER, MIC CASE REAR	70-157016
	SCREW, CASE	70-151076
	WEIGHT, BALLAST	70-151369







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